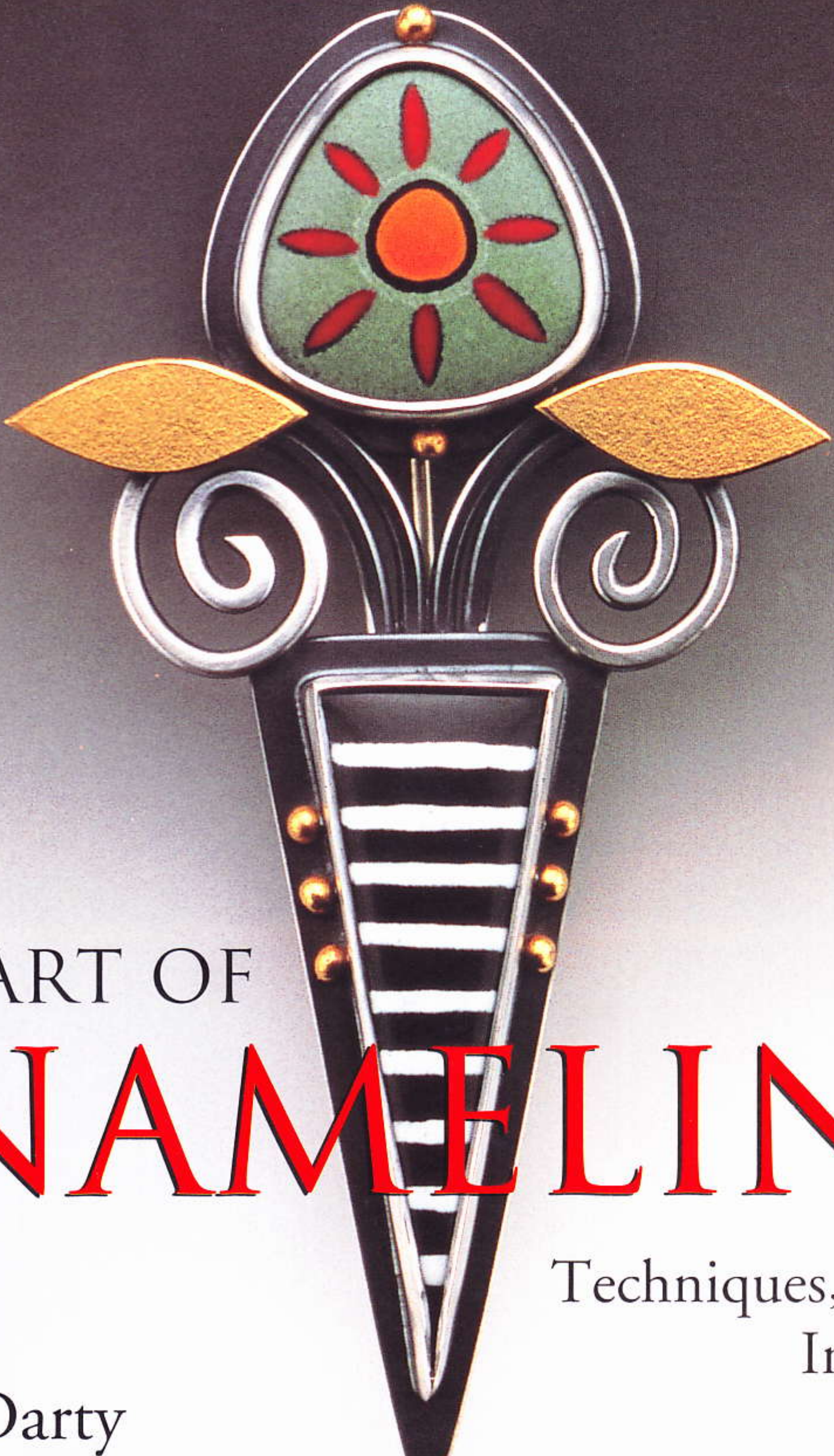
LARK JEWELRY
& BEADING

"The most breathtakingly beautiful and informative book on enameling published in recent years. Highly recommended." —**Belle Armoire**

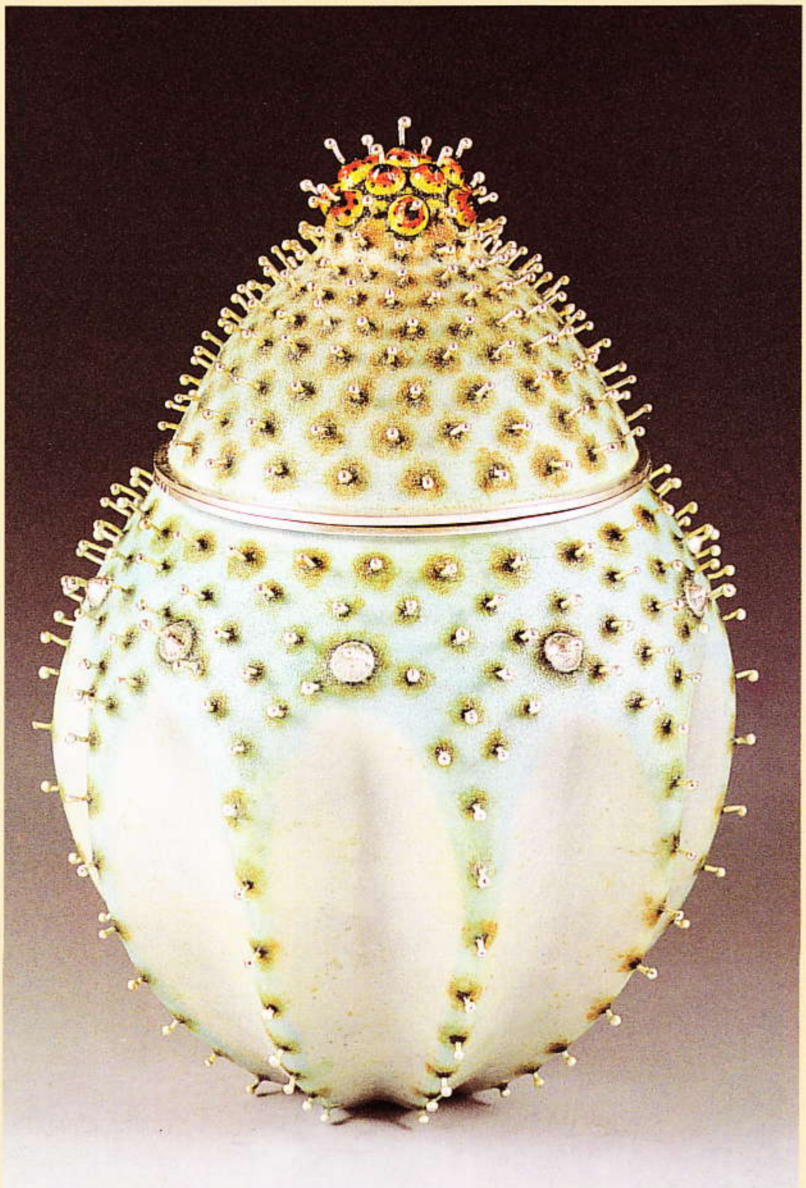


THE ART OF
ENAMELING

Techniques, Projects,
Inspiration

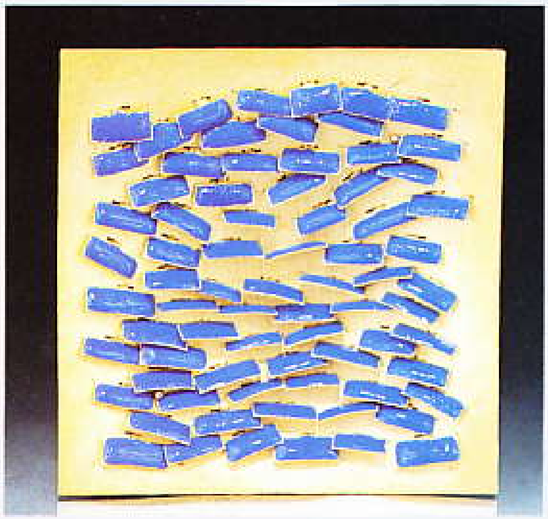
Linda Darty

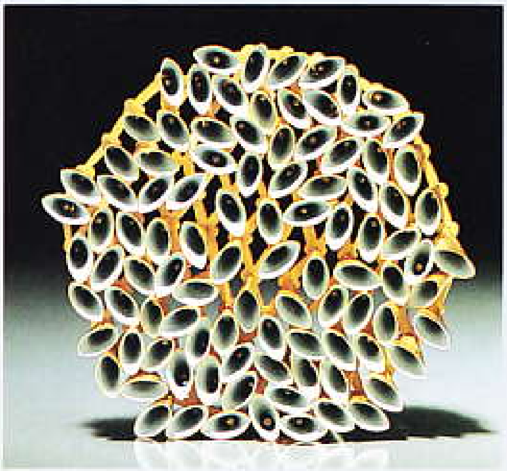
Enameling Fundamentals



Sarah Perkins *Cactus Container,* 2004. 6 x 4 in. (15.2 x 10.2 cm). Fine silver, enamel. Photo by artist.

In this chapter, you'll learn basic enameling skills including the different types of enamels and their characteristics, what metals you can use for enameling, how to set up an enameling studio, and what tools and equipment you'll need. You'll understand how to clean the metal, prepare and apply the enamel, fire a piece, and clean between firings. You'll find out how to remove enamel if you make a mistake, don't like a color, or discover unwanted pits or impurities in the glass. You'll learn to finish the glass, an important part of the enameling process that allows you to control surface textures. You'll be able to create enamels that are highly glossy, silky satin, frosty matte, and even sugar- and pebble-textured. I've included a section on ways to set a finished enamel in metal, so you can consider your options before you design a piece. There is also a section that gives you a simple method for testing enamel colors, so you'll be well-prepared to work with shading and layering colors as required in the second section of this book, Enameling Techniques. If you're new to enameling, it's important to read and understand this section completely. If you already feel comfortable with the basics, you may want to glance through this information to refresh your memory, and then move on to the second section and begin exploring various techniques.





Right: Jacqueline Ryan *Brooch*, 1996. 2¼ x 2¼ in. (5.7 x 5.7 cm). 18-karat gold, enamel. Photo by Giovanni Corvaja.

Far right: Jacqueline Ryan *Brooch*, 1999. 2⅕ in. (5.5 cm). 18-karat gold, enamel. Photo by Giovanni Corvaja.

Enamel & Enameling

Vitreous enamels were useful to ancient craftspeople because they could serve as substitutes for precious gemstones in jewelry and ceremonial objects. The earliest colors were meant to replicate specific stones: cobalt glass replaced rare lapis lazuli, opaque blue-green represented turquoise, and a reddish brown color could substitute for garnet or carnelian. Even before the earliest enamels were created, ancient artists had a fascination with glass; the Mycenaean Greeks used to string pieces of glass pierced with holes to create necklaces and other jewelry objects, and stone molds to cast molten glass have been found in Greece. By 2,000 BC, craftspeople had become adept at working with bronze and were able to solder gold and silver, therefore setting the stage for the first developments in enameling technique.

THE PROPERTIES OF ENAMEL

Manufacturers of enamel today carefully test the properties of the glass they make. They control the composition so that it bonds to different metals and has different physical properties related to its *softening point*, (which indicates the temperature when the enamel will begin to move or flow) *fusion flow* (which indicates the rate or speed that it will flow at a particular temperature) and *coefficient of expansion* (the increase in the length, or volume of the enamel during heating, the "fit" or compatibility with the metal).

Though as artists we usually purchase the enamel without regard to this information, it's helpful to understand these physical properties so that as you become familiar with the colors you use, you'll know why they react to layering and firing in certain ways. Sometimes for example, a color may be listed from the supplier as Hard, Medium, or Soft. This relates to the softening point of the glass, and how hot it should be fired. (Enamel does not melt; it softens and flows.) Not the same as the enamel's softening point, the fusion flow is more descriptive of how quickly the enamel spreads and smooths out. Two different enamels might soften at the same temperature, but one could flow and smooth out more easily than the other one, a fact you might be concerned with if you work on vertical surfaces. This helps us understand why some enamels break through the colors that are fired on top of them. An enamel with a high fusion flow (which flows out and smooths easily) and a lower softening point (which fires at a lower temperature) would work best if used on top of an enamel which fires at a higher temperature (that has a higher softening point and flows less quickly.) If the enamel that fires at the higher temperature is used on top, the softer color will flow and break through the harder color. Not all enamels are marked or labeled to indicate their softening points, fusions flows, and coefficients of expansion, but as you use colors you'll soon learn about these properties, even if your understanding of how they fire is more intuitive than analytical.

HOW ENAMEL IS MADE

To make enamel for metal a combination of raw minerals (such as silica, soda ash, and potassium nitrate) are mixed according to each enamel formula and put into a preheated crucible, similar to the way glass blowers make raw

Left: Sydney Scherr *Floating*, 2001. 3¾ x 3½ x ½ in. (9.5 x 8.9 x 1.3 cm). 24-karat gold, 22-karat gold, 18-karat gold, fine silver, opalescent enamel, blue pearl, opal beads; fabricated, hand engraved, cloisonné. Photo by Seth Tice-Lewis.

Far left: Jamie Bennett *Florilegia Brooch*, 2003. 2¾ x ½ in. (6.9 x 1.3 cm). 20-karat gold, enamel. Photo by Dean Powell.

"batch" for glass blowing. Changing the proportions of the minerals in the formula will change the properties of the enamel (its softening point, fusion flow, and coefficient of expansion). Ceramic pigments can be added to the glass to control color; for example cobalt makes blue, chrome green, cadmium is in yellows. (Though many artists often say it is "oxides" that combine with glass to create color, some of the organic pigments contain oxygen, but others do not. The oxygen in cobalt oxide, for instance, has nothing to do with producing the color.)

Insoluble crystals can be added to decrease the transparency of the color and make it more opaque. Once the glass is heated to the correct temperature for the correct amount of time it takes to melt the minerals, a viscous liquid is created. This glass is removed from the crucible, air cooled on an iron plate or in water, then shattered into lump or flake enamel (see photo A). The enamel is then ground into granules that are measured by passing the powdered glass through a screen with a standardized number of openings in 1 linear inch (2.5 linear cm). The more openings in the screen per inch or centimeter, the smaller the granules that pass through it. This screening determines the enamel mesh size and most commercial enamels are sold as 80 mesh.

A

TYPES OF ENAMEL

Depending on the composition of the glass, enamel can be clear, transparent, opaque, or opalescent. Opaque colors completely block what's beneath them from view. This applies to both the surface of the metal and other enamel layers. Opalescent enamel is a translucent glass that's not completely clear. Its milky appearance is similar to that of an opal gemstone. Transparent enamel can be either completely clear or a color.

LEAD-BEARING & LEAD-FREE ENAMELS

Lead-bearing and lead-free colors are available to enamel artists. I use them both, primarily basing my choice on the color or technique I want to use. Here are some guidelines to help you make an informed decision.

- Lead-free colors are much safer to use than lead-bearing colors.

- Lead-bearing enamels are available in a much greater range of colors. This is because more companies manufacture lead-bearing products.

- Lead-bearing enamels are safer to use when you apply them wet as shown above. By mixing wet enamels in a watercolor tray, you're less likely to breathe sifted dust containing lead. Because there are more colors, and

Right: Marilyn Druin
Golden Sampler, 2001. 2⅓ x 2⅓ in. (5.9 x 5.9 cm). 24-karat yellow gold, 18-karat yellow gold, fine silver, enamel; cloisonné, guilloché, basse taille. Photo by Bob Barrett.

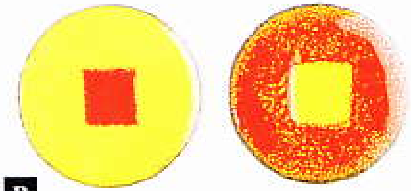
Far right: Felicia Szorad
Canteen Bag, 2001. 10 x 7 x 5 in. (25.4 x 17.8 x 12.7 cm). Sterling silver, bronze, copper, enamel. Photo by Taylor Dabney.

because they are safer when used wet, I often choose lead bearing colors for cloisonné or champlevé enameling techniques. You could, however, use lead-free colors just as easily.

- Using lead-free colors when sifting dry enamels reduces your exposure to toxic lead. However, both lead-free and lead-bearing glasses contain other metal oxides and pigments that are toxic to inhale. Always wear a safety mask when sifting dry colors.

- Lead-free enamel colors are more acid-resistant. You should use them when you intend to clean firescale off an uncoated copper surface with an acid solution. (For more information on this technique, see page 25.)

- Always choose lead-free colors when you plan to torch-fire enamel. This decreases your risk of breathing lead fumes emitted during torch-firing, and when affected by the carbon in the torch flame, lead-free colors don't discolor as easily as lead-bearing colors.



B

As explained earlier, when enamel is heated it expands and the measurement of this change is called its *coefficient of expansion.* Due to the different coefficients of expansion of lead-bearing and lead-free enamels, they seem most stable in combination when the lead-bearing color is used on top of the lead-free color. For example, a small amount of a beautiful red lead-bearing color might serve well as a final inlayed area in an overall lead-free enameled piece. The opposite combination is also possible, though sometimes when the lead-free color is applied on top, the lead-bearing bottom color breaks through and creates a texture (see photo B). It is interesing to know that both lead-bearing and lead-free enamels were used together in Limoge, France, in the 16th century. These two types of enamel still work together, even if "sandwiched" in layers. A single grain of lead enamel on a lead-free surface, however, can cause a pit to occur.

My suggestion to any beginning enamelist is to start with a limited number of transparent and opaque colors, depending on your preference. You can use a lead-free palette, a lead-bearing palette, or, perhaps even a combination of the two. Experiment with layering just a few colors in many different ways. Learn what combinations work best for you and create effects you enjoy. Although over the years I've collected shelves of enamel colors in my studio, I find that I usually work with the same colors over and over again, adding new ones only occasionally.

Enameling Materials

One of the great advantages contemporary enamelists enjoy is the opportunity to purchase enamel in many forms. In comparison to the medieval artists who made the glass for each enamel in hand-built wood-heated furnaces, our options are incredibly convenient, offering many more diverse and straightforward ways to work with glass on metal. As you explore the Enameling Techniques section of this book, you'll learn how to use each of these materials.

POWDERED ENAMEL

Most commercial powdered enamels are sold as 80-mesh. You can make or purchase your own 60-mesh, 80-mesh, 100-mesh, 200-mesh and 325-mesh screens and sift enamel powder into smaller particle sizes, separating it for different applications.

PAINTING ENAMELS

With particles typically ground smaller than 325-mesh, painting enamels are even finer than liquid enamels. You can purchase painting enamels premixed with oil in tubes, or you can buy them dry and mix them with oil or water as needed. When mixed, painting enamels are very similar to artist's oil paints, and you can apply them in layers over fired enameled surfaces.

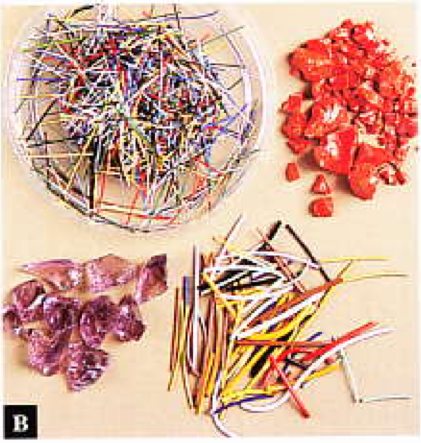
WATERCOLOR AND ACRYLIC ENAMELS

These enamels are easy to work with for those who like to paint and draw. Water-based enamel paints are sold in tubes like acrylics and in pans like watercolors.

ADDITIONAL MATERIALS

More interesting materials for enameling include: underglaze pencils, chalks, ceramic pigments, and crayons (photo A); lumps, chips, and threads (photo B); and decal papers (photo C).

A



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C

LIQUID FORM WATER-BASED ENAMEL

You can purchase lead-free liquid enamel, premixed with water or in dry form. Liquid enamel consists of glass and additives to control the drain and set time. These components are ground together until all but a small percentage passes through a 200-mesh screen.

FAST FACTS & HELPFUL HINTS

— Vitreous enamels are composed of glass and inorganic pigments, such as cobalt, used to produce color. The mineral composition of the glass gives it different properties related to its softening point, flow rate, and fit to the metal.

— Powdered enamel is ground to varying degrees and designated by mesh size. For many sifting applications, 80-mesh and 150-mesh powders are practical sizes. These particles have a similar consistency to sugar or table salt. If needed, you can sift finer enamel by using different size mesh screens. For painting, 200-mesh and 325-mesh powders are better choices.

— You can purchase transparent, opaque, or opalescent enamel colors as well as clear enamel, which is commonly called *flux.*

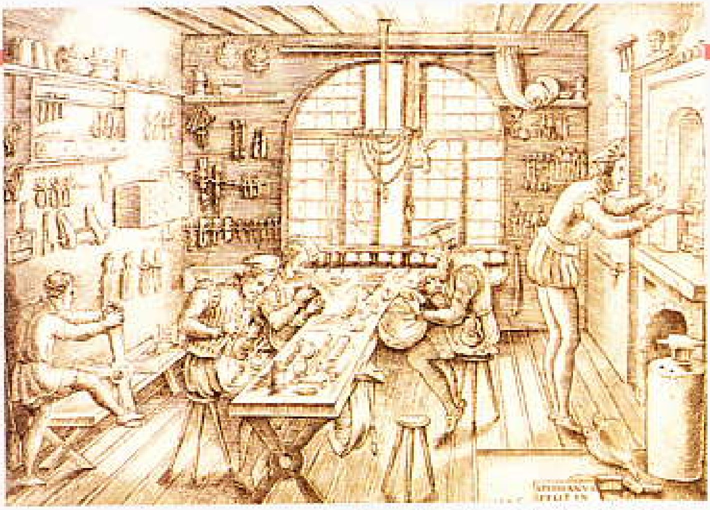
— Lead-free enamels are safer to use and more acid-resistant. Lead-bearing enamels are available in a wider variety of colors. All enamels, both lead-free and lead-bearing, contain ingredients that can be hazardous when inhaled.

— A lead-bearing color fired on top of a lead-free color is compatible more often than a lead-free color fired on top of a lead-bearing color. You should try the reverse application, as it sometimes yields interesting textural effects.

HISTORICAL HIGHLIGHT

Theophilus Presbyter, a 12th-century German monk, described preparing enamel and testing its properties in his medieval treatise, *On Divers Arts:*

> ...take all the kinds of glass you have prepared for this work and breaking off a little from each piece put all fragments at the same time on a single sheet of copper, each fragment, however, by itself. Then put it into the fire and build up coals around and above it. Then while you are blowing observe carefully whether the fragments melt evenly; if so, use them all; but if any fragment is more resistant, lay aside by itself the stock that it represents. Now take all the pieces of tested glass and put them one at a time in the fire and when each one becomes red-hot throw it into a copper pot containing water, and it will immediately burst into tiny fragments. Quickly crush these fragments with a pestle until they are fine. Wash them and put them in a clean shell and cover with a linen cloth. Prepare each color separately in this way.



Etienne Delaune *Goldsmith's Workshop,* 1576. 3$\frac{1}{10}$ x 4$\frac{7}{10}$ in. (8 x 12 cm). Engraving. © Copyright The British Museum.

Left: Jane Short *Weavers Bowl: The Worshipful Company of Weavers*, 2002. 15 in. diameter (38.1 cm). Silver, enamel; champlevé, basse taille. Photo by Clarissa Bruce.

Far left: Valeri Timofeev *Box*, 2001. 1½ x 3 x 2¼ in. (3.8 x 7.6 x 5.7 cm). 18-karat gold, diamond, enamel; plique-à-jour. Courtesy of a private collection. Photo by artist.

Preparing Enamel

To determine how to prepare the enamel before applying it, carefully study the object you're making. Is it flat or three-dimensional? Will a holding agent be needed to help the enamel adhere to the metal surface? Since smaller particles create less bounce when sifted and adhere better to metal edges, would it be better to sift with 80-, 150- or 200-mesh enamel? Would it be easier to spray, paint, or pour on liquid enamel? Once you thoughtfully study the piece, you can prepare the enamel.

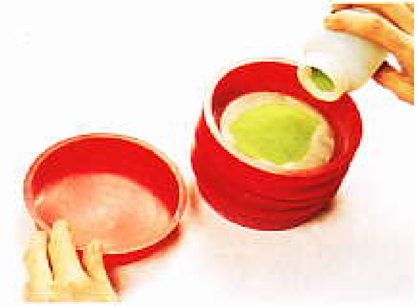
POWDERED ENAMELS & PARTICLE SIZE

Enamels are manufactured in various grits, or particle sizes. The grit size is measured by passing the powdered glass through a mesh screen with a standardized number of openings in 1 linear inch (2.5 linear cm). The more openings in a screen per inch (or centimeter), the smaller grit it will filter. You can make or purchase your own 60-, 80-, 100-, 200-, and 325-mesh screens. With them you can sift and separate enamel powder, typically purchased in the 80-mesh grit size, into smaller particle sizes for different purposes.

If you want to use a variety of enameling techniques with ease, it's important to understand particle size. For applications that require great enamel clarity, such as wet packing over gold and silver, working with a larger particle size, such as 80 mesh is advantageous because the fired glass will be more transparent. For applications such as fine painting, you may prefer using a smaller particle size, such as 200 or 325. Finer enamels are less grainy and flow more smoothly. Prior to sifting, if you remove enamel particles larger than 150 mesh, the enamel is less likely to bounce off the edges of the metal. This preparation can even eliminate the need to use holding agents to adhere the sifted enamel to the metal before firing. (For more information on holding agents, see page 31). However, if the particle size of a sifted base coat is too fine, it will likely pull away from the edges and toward the center of a metal piece.

SEPARATING MESH SIZES

The first step in preparing enamel is to separate the correct particle size for your application. You can use a sequence of screens to sift particles to the desired size.



1. Stack the enamel sifters of various mesh sizes. Arrange them so the sifter with the largest mesh openings is on top, and the finest mesh is on the bottom, directly above a collecting tray.

Above: Sarah Turner Untitled, 2002. 5 x 6 in. (12.7 x 15.2 cm). Copper, enamel. Photo by artist.

Right: Nancy Bonnema *Shuttle*, 2002. 4 x 1 in. (10.2 x 2.5 cm). Sterling silver, enamel, riso screen. Photo by Doug Yaple.

2. Place a quantity of 80-mesh enamel in the top tray.

3. To keep dust down, cover the top sifting tray with another tray or lid.

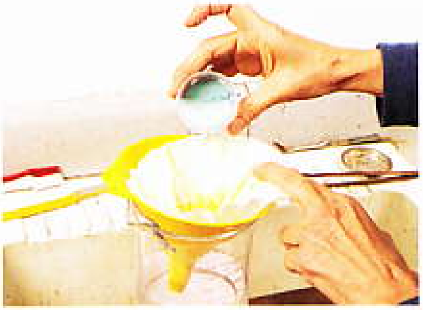
4. Shake the stacked sifters. The enamel will fall through the screens, according to its particle size. The largest particles will remain in the top tray. They will be the most transparent enamel and should need little or no washing, depending on their use. The finest enamels fall to the bottom collecting pan. (Save these for painting projects.)

WASHING ENAMELS

Commercial enamel manufacturers use ball mills to grind their stock. By-products of this process include porcelain dust, a fine enamel dust residue. These impurities affect the clarity of transparent enamels, causing them to appear cloudy and less brilliant. Even if you remove the fine powders by pre-sifting commercial enamel through 200- or 325-mesh screens, you'll need to wash the remaining enamel for optimum clarity. (This is especially important when luminous transparency is critical to the work, such as firing transparent colors over gold foils, silver foils, or textured surfaces.) If you want to sift out the fine enamel to save for painting projects or counter enameling, do this before washing it. Because washed enamel has a shorter shelf life, wash only the amount you need relative to the size of a piece. I usually wash two to three ounces (56.6 to 85 g) at a time.

How to Wash Enamel

1. Place the enamel color you're washing in a clear container (glass or plastic), and add at least twice the amount of water. Cover the container with a tight-fitting lid, and then shake or swirl it so the water becomes cloudy.



2. Allow the enamel to settle on the bottom of the container until a fine line settles on the top of the enamel. Pour off the cloudy water into a second container. (If you want to save the fine particles as you pour off the cloudy water, use a coffee filter as a strainer.)

3. Repeat steps 1 and 2 until the water you pour off is clear. I recommend using distilled water for the final two washings in case the tap water you're using contains chemicals that might cause the enamel to break down more quickly.

Katy Bergman Cassell *Hollow Ball Necklace: White*, 2002. 18 x 1¾ in. (45.7 x 4.4 cm). Copper, sterling silver, enamel. Photo by artist.

Sarah Krisher *Formal Arrangement*, 2002. 2 in. (5 cm), 3½ in. (8.9 cm). Copper, silver, enamel. Photo by Robert Muller.

Applying Enamel

THE IMPORTANCE OF AN EVEN BASE COAT & COUNTER ENAMEL

Coating both sides of the metal with enamel evenly distributes the stress of expansion and contraction, can prevent cracking, and can lessen warping. The coat on the front of the piece is called the base coat, and the coat on the back is the counter enamel. For most techniques, it's important for the base coat to be as even and complete as possible. (An exception to this would be when you leave copper areas exposed to intentionally create firescale.) It will warp less if the counter enamel is about as thick as the base coat and has the same coefficient of expansion. Before applying the counter enamel or the base coat, decide whether or not to use a holding agent to better adhere the enamel to the metal during application and firing.

USING HOLDING AGENTS

A holding agent is an organic binder that makes it easier to control and work with the enamel during application. Holding agents also help adhere the powdered glass on dimensional, sloped, or vertical surfaces during firing. Sometimes a holding agent isn't necessary, such as when you apply enamel to a flat surface, but it is important to use one when working on a wire structure, for example, or on the steep sides of a vessel. You should use holding agents sparingly and only when required. Before you fire a piece, make certain the binder is completely dry. It must also completely burn out so ash and gas bubbles aren't trapped in the enamel layers. (These could surface during later firings.) Although you gain greater control by using holding agents, you'll sacrifice some clarity with transparent colors.

Use water to dilute by half a water-soluble holding agent before using it to apply a base coat or counter enamel. Immediately before sifting, apply the binder to the metal surface with a soft flat paintbrush (photo A) or a pressurized spray bottle (photo B). (There are other oil based holding agents such as squeegee oil or oil of lavender that are often used with painting enamels, but in most cases I do not use them to hold base coats and counter enamels in place.)

A

B

When creating the complex dimensional forms pictured in the gallery photo above, Katy Bergman Cassell found that squeegee oil was the best binder to use for the sifted enamel because it dries slower than water-based binders.

SIFTING

It's very easy to evenly apply enamel using the sifting technique. You'll use specially prepared screens of various mesh sizes and sift dry enamel through them onto metal surfaces.

Preparing to Sift

Before you begin, prepare a clean area for sifting, wear a dust mask for safety, and have plenty of clean magazine pages nearby to catch excess enamel. By using slick magazine paper rather than newsprint, you can easily pour extra enamel back into its container. If you place a second clean page beneath the one on which you're sifting, it will keep the back side of your catch paper clean. Otherwise, when you make a pouring funnel to return the

Left: Rebekah Laskin *Brooch*, 2000. 2½ x ½ in. (6.4 x 1.3 cm). Copper, onxy, 18-karat gold, enamel. Photo by artist.

Far left: Barbara McFadyen *Standing Stone Series–Brooches*, 1999. 2½ to 2¾ x ¾ in. (6.4 x 6.9 x 1.9 cm). 24-karat gold foil, underglaze, embossed sterling silver, 18-karat bimetal, black druzy. Photo by Ralph Gabriner.

enamel to its container, stray dirt or colored enamel particles could fall from the back side of the catch paper and contaminate the enamel. Protected by the second page, the back of the catch paper stays clean!

Sifting a Base Coat or Counter Enamel

1. Choose a sifter that's the appropriate size for the piece you're enameling. You wouldn't want to use a very small sifter to sift enamel on a very large metal piece or a very large sifter on a tiny metal piece.

2. Fill the sifter no more than one-third full of dry enamel. This makes the particles fall through the screen more easily.

3. Spray or thinly paint a holding agent onto the piece if its shape requires one.

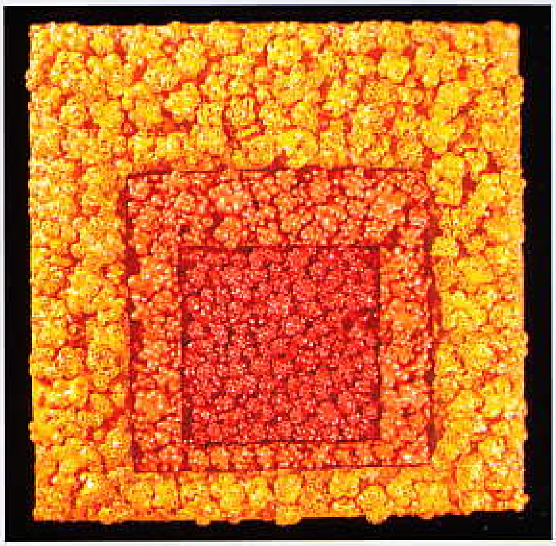
4. Sift the enamel onto the metal in an even rhythm, using overlapping paths. The movement of the sifter makes the enamel particles fall through the screen. To accomplish this I hold the sifter against my third, fourth, and fifth fingers. I rest my thumb on the top of the sifter for control and my index finger against its side. I tap the sifter with my index finger, and depending on the size of the piece I'm sifting, I also might use my wrist or even my elbow to create more movement.

5. Begin at the outside edge of the metal and sift in concentric circles toward its center. Sift extra enamel on the outer edge, where, during hot firings, the enamel is more likely to pull away.

6. Always keep the sifter at a 90-degree angle to the worktable. Tilt the metal piece if necessary, not the sifter.

7. Hold the metal in your hand, resting it on the top of your fingers when you sift. This way, immediately following sifting, you can easily transport the piece to a trivet in preparation for firing. If the piece is flat on the table while sifting, the enamel on its edges may be disturbed when you pick it up to move it to a trivet. If you make it a habit to sift enamel while the piece is on the trivet, the trivet eventually becomes coated with enamel. It takes practice to learn to sift skillfully so the enamel coats the metal surface evenly, without excess.

Right: Sarah Perkins *Sophia Container,* 2000. 6 x 4 in. (15.2 x 10.2 cm). Silver, onyx, enamel. Photo by Tom Mills.



Far right: Veleta Vancza *Confiscation of the Square,* 2002. 16 x 16 x 3 in. (40.6 x 40.6 x 7.6 cm). Copper, wood, enamel. Photo by John Guillemin.

8. Re-apply a light spray of the holding agent after the first sifting if necessary. (I only recommend this for sifting on very dimensional pieces.)

9. Let the piece completely dry before firing if a holding agent was used. If you place the sifted enamel on top of a hot kiln or under a heat lamp, this takes only a few minutes.

Cleaning Workspace After Sifting

When you're finished sifting each color, fold the used magazine papers in half, and then in half again, and place them in the trash. Frequently wipe table surfaces. Keep the lids on containers whenever possible to prevent contamination by dust or other enamel colors. These studio practices help keep dust to a minimum.

WET INLAYING

When applying various colors next to each other for shading or special effects, using wet enamel gives you more control. It's also an easier way to apply enamel around soldered findings or in hard-to-reach places where other areas of the finished piece won't be enameled. I often use the wet inlay technique as a base coat or a counter enamel on dimensional or champlevé etched pieces.

Wet Inlaying a Base Coat or Counter Enamel

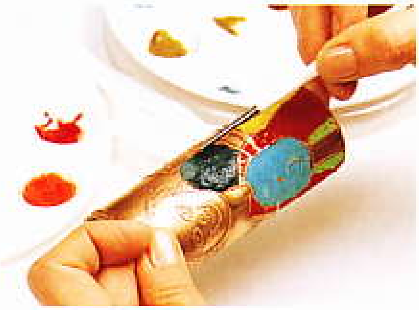
A

B

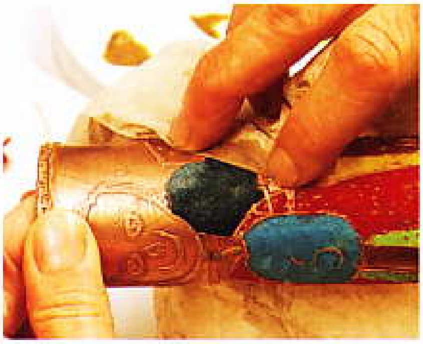
1. If the enamel you'll be using is dry, put a small quantity in a shallow dish or paint tray (photo A). Using an eyedropper, syringe, or squeeze bottle (photo B), add just enough water drops to cover the dry enamel, and let the water soak into the glass. (Don't mix or stir the enamel. This creates air bubbles that could later be trapped in your piece.)

C

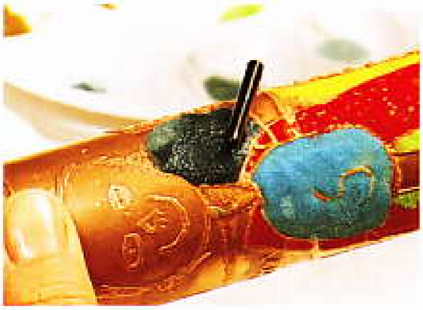
2. If the enamel you'll be using has been washed and stored wet, scoop a small amount of the wet color into a shallow dish or paint tray. Add a few drops of water-based holding agent to the wet enamel if necessary (photo C). Allow the binder to settle into the mixture. Do not stir it and create air bubbles.



3. Using a spatula and fine sable paintbrush (such as the 000 size) or a spatula and an inlay tool, pick up some wet enamel and hold it over the piece. Gently transfer the enamel mixture onto the metal and push it into place with the paintbrush or tool. (Although this is the traditional technique, I also inlay wet enamel without using the spatula. I simply use a paintbrush to pick up the color and directly transfer it onto the piece.)



4. If the enamel is too wet, it will spread out or flow down sloping sides. To remedy this, hold the corner or edge of a clean linen or lint-free cotton or paper towel next to the wet enamel. (Brown paper towels work well.) Let the towel absorb, or wick, the excess water. As you wet inlay, you may want to frequently wick the enamel, especially if you don't want adjacent colors to bleed.



5. As you wet inlay, gently tap the sides of the piece or the surface of the wet enamel to level it.

6. You also can smooth the surface with a bent wire tool or a paintbrush. Use a dabbing motion, not a painting or pulling one. It may feel like you're pushing around sand or sugar grains with the tip of the brush.

LIQUID ENAMEL

Dipping, pouring, painting, or spraying liquid water-base enamel is a similar technique to glazing pottery, and it works especially well for some pieces. Using liquid enamel makes it easier to coat the inside of hollow objects, such as containers or beads, because you can pour it in and out of forms. You can purchase this type of enamel in liquid form or as a dry powder that you mix with water before use. Some practice is necessary to apply an even coat of liquid enamel, but if it's the correct consistency and well mixed, you'll have an easier application. (Refer to pages 97–104 for ways to use liquid enamel to create special effects.)

Preparing & Applying Liquid Enamel as a Base Coat or Counter Enamel

Premixed liquid enamel is usually a good consistency for brushing or dipping. You can, however, add small amounts of water to the mixture until it reaches the consistency you like.

A

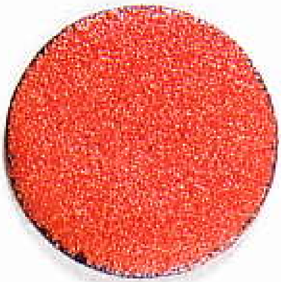
B

To prepare dry liquid-enamel powder, only use a small amount of water. Pour the powder into the water, as if mixing plaster (photo A). Let the powder soak for a few minutes, and then gently mix it with a spoon (photo B). Add more powder or more water to the mixture until it's the correct consistency for your application. Experiment to determine what works best for you.

C

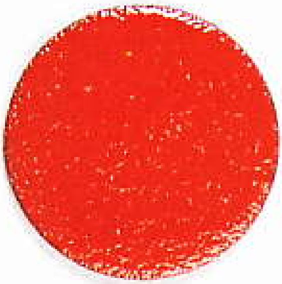
You may need thinner liquid enamel if you're painting or air brushing it onto metal. Slightly thicker liquid enamel is often preferable for pouring techniques. I use the same finger-dipping test I learned for applying glazes to pottery. I dip my finger into the liquid, pull it out, and see how thickly the mixture coats my the reflections on the piece as you peek through the door of the kiln.

SUGAR-COAT TEXTURE



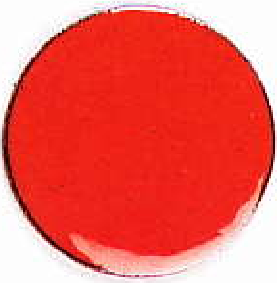
Within the first minute of firing a sifted enamel, the sugar-coat texture begins to form.

ORANGE-PEEL TEXTURE



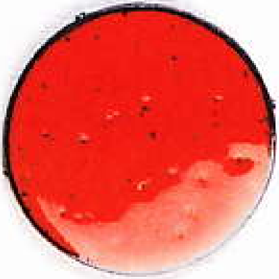
As the glass softens and begins to fuse it forms a new texture, sometimes referred to as "orange peel," after the surface of the fruit skin.

FULLY FUSED SURFACE



A fused enamel surface is even and glossy.

OVER-FIRED SURFACE



On an over-fired piece, copper oxides may darken areas of the enamel.

CONTROLLED OVER-FIRING

With practice, you can create special effects on an enamel surface through deliberate and controlle over-firing. Fae Mellichamp's thre necklaces pictured in the gallery page 41 were all coated with the same clear enamel. The variation color is the result of different firir times and temperatures.

Over-firing to Clear Transpare Enamels or to Create Copper Oxide Coloring

When over-firing most colors directly on copper, the color will change somewhat as the oxide i taken into solution with the glass This might look like a green copp oxide halo or shadows of green, perhaps dark black specks or bla beneath some opaque enamels. the case of transparent enamels sifted directly on copper, over-fir is used with control so that the c per oxide will be taken into solut with the glass, and the color will more transparent (see Working v Enamel Colors, pages 48–50).

Enameling Techniques

William Harper *The Virgin and the Unicorn*, 1988. 6½ x 3 in. (16.5 x 7.6 cm). 14-karat gold, 18-karat gold, 24-karat gold, sterling silver, enamel, tourmalines, amethyst, pearls; cloisonné. Collection of The Victoria and Albert Museum, London, England. Photo by The Victoria and Albert Museum, London, England.

THIS SECTION IS WHERE you'll be able to apply all the fundamentals you learned earlier and start enameling! The techniques here are presented in the same order that I teach them to my university students. We begin with many ways to control sifted enamel, then learn to blend colors using drawing and painting techniques and liquid enamels. Practice firing, sifting, blending, and painting with enamel will help develop the enameling skills needed for pieces that are more labor intensive and time consuming in their metal preparation, such as cloisonné, champlevé, plique-à-jour, or dimensional pieces. Even though some students may feel impatient and want to jump in and make a champlevé or cloisonné piece in the beginning, they always thank me later for teaching them to enamel on pieces that do not involve long hours bending wires, etching, or sawing out sheet.

Browse through the various techniques presented in this section before you begin making your own samples. Choose those that appeal to you most, and read carefully to understand how they're made so that you can move ahead confidently.

If you're a beginner, I suggest you practice on inexpensive copper, making many samples as you improve your skill. Because of the rhythm of enameling procedures, (letting things cool, or dry) it's a good idea to work on several small sample pieces at once, trying different techniques and colors simultaneously, and always having another piece of copper ready for testing what you've learned on the last piece. For me, the only monotonous task is cutting and cleaning the metal and applying the base coats or counter enamels, so I do this on several pieces at one time, setting them aside for later use.

In most cases, for the sake of clarity, only one technique is used on pictured samples. It will be much more fun for you though, to try several techniques on the same sample piece. Keep the samples you make at your worktable and as you learn something new, pick one up and continue working on it, responding to what is already there and enjoying the new things you're learning.

Sifting Techniques

Right: Morgan Brig *Have You Ever Loved Your Life?*, 2003. 25 x 20 x 2 in. (63.5 x 50.8 x 5 cm). Copper, enamel, mixed media. Photo by Christopher Conrad.

Far right: Daniel Jocz and **Becky Brannon** *Marlene Series: Cherry Solitaire*, 1998. 2¼ x ⅞ x ⅞ in. (5.6 x 2.2 x 2.2 cm). Copper, silver, gold, enamel. Photo by Dean Powell.

THOUGH YOU MAY remember sifting as the enameling technique you learned in grade school or at summer camp, don't overlook it as a way to create exciting and expressive artwork. Sifting is also referred to as "dusting," and though the technique itself is simple, the effects that can be created are amazingly rich and varied. Transparent and opaque colors can be sifted and fired during the same firing. They can be used over and under each other, next to each other, overlapping or separated with soft or sharp edges. An easy way to learn about how your colors look together is to make several sifted pieces using colors in different combinations.

You learned how to sift evenly when applying base coats and counter enamels or made color tests. In this chapter, you'll learn other ways to control and work with sifting techniques to create special effects and interesting surfaces. Many thin layers of color can be sifted and combined for special effects, to create rich textured surfaces, and to define and draw shapes, lines, and patterns. With controlled firing techniques, the visual and tactile surface of even one single layer of sifted glass can be an effective way to define and emphasize form on dimensional work.

SIFTING OVER STENCILS

Stenciling is a simple way to create a design in enamel and to control the application of more than one color. A stencil is something you hold over the surface of the metal or enamel to block the grains of glass as they fall through the sifter. Make or use found materials for stencils and work in thin coats, with as many layers and firings as you like. Be creative as you choose stencils. You might try wet or dry brown paper towels, perforated or cut sheets of typing paper, metal that has been drilled, sawn, or etched completely through its surface, silk screens, open-weave fabrics, and organic or manmade shapes you live with every day. To capture fine details, sift through or around the stencils with 200-mesh or 100-mesh enamel so the smaller particles of glass will define the intricate areas of the design. With larger stencils, regular 80-mesh enamel works fine. You can sift more than one color on a piece for a single firing if you apply it thinly. If you apply too much enamel, it could build up and create expansion and contraction problems, resulting in cracks in the glass.

Don't forget to incorporate firescale into the design if you wish. If you leave some areas of the copper bare, they will be covered with firescale after firing. You can clean them in pickle or leave the areas dark as part of the design. If you later coat the firescale areas with clear enamel, they will appear reddish brown.

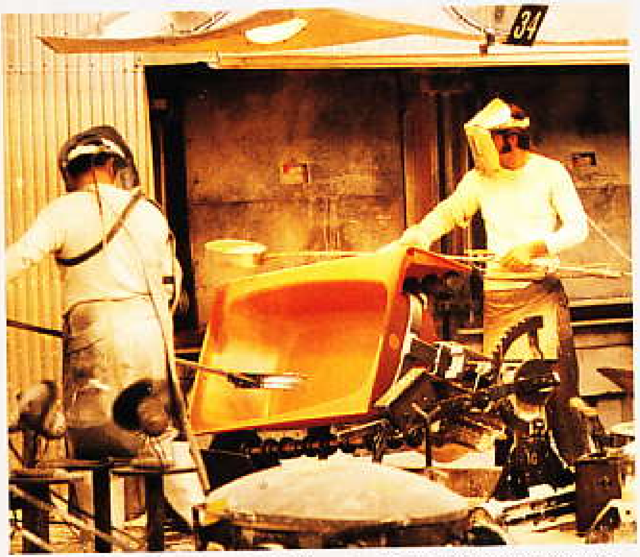
You can vary the effects of the stenciled design by working with opaque and also transparent color. The transparent color will allow the shapes beneath to show through, and the opaque color can be used to completely change or cover an area beneath it. Stenciling is a great first project if you are learning to enamel because you can quickly create designs and learn how colors work together while also getting plenty of practice firing.

Using Wet or Dry Paper Stencils

1. Cut stencil shapes out of soft paper. (I suggest brown paper towels because they are relatively lint

HISTORICAL HIGHLIGHT

Sifting techniques may have been put into practice when enamellers first realized that no metal partitions were necessary in their work. At some point, someone decided it was easier to sift color across a large surface than to use a paintbrush. Covering an entire metal surface with enamel was first practiced by enamellists in Limoges, France, during the 15th century, but we don't know if they wet packed or sifted their base coat enamel layers.



Kohler Co. Enamel Shop, 1973. Courtesy Kohler Company, Kohler, Wisconsin

In 1764, Robert Dossie wrote *The Handmade to the Arts*, an important publication regarding early craft practices. It appears from his text that prior to 1764 the technique of sifting was used for two enameling purposes: to classify the grain size, and to apply the enamel. Dossie explains in his text that the method was to, "rub the surface to be enameled over with oil of spike; and then, being laid on a sheet of paper or piece of leather, to save that part of the enamel which does not fall on a proper object, to sift on the oiled surface until it is the proper thickness." He explains that, "great care must be taken when using this method not to shake or move too forcibly the pieces of work thus covered with the powdered enamel."

In 1873 at the age of 29, John Michael Kohler, an Austrian immigrant, purchased an iron and steel foundry and began making steel implements for farmers, as well as castings and ornamental iron pieces. In 1883 he was launched into the plumbing business when he got the idea to bake enamel on a hog scalder, creating Kohler's first bathtub. It's interesting to witness the large-scale sifting and enameling currently being practiced at the Kohler Company. In their enamel shop, 33 enameling furnaces are presently in use. The interior dimensions of these furnaces are 8 feet (2.4 m) deep, 6 feet (1.8 m) wide, and 6 feet (1.8 m) high. The cast iron pieces are loaded into the furnace and preheated to approximately 1600° F (871° C) before being removed. A sieve with an air vibrator is used to sprinkle enamel on the pieces while they are red hot. The pieces are then reloaded into the kiln where the enamel fuses to the cast iron. If the enamel was applied to cold metal, the glass would flow and fuse faster than the iron heats, causing crawling and faulty bonding.

Sifting is a technique used by many enamellists in a variety of ways. Kenneth Bates, fondly known to many as the "Dean of American Enameling" is no exception. A master of many enameling techniques, he began studying enameling in 1924 and only a few years later began teaching it to his students at the Cleveland Institute of Art. Bates' influence as a teacher and author of enameling books has been significant and many important American enamellists working from the 1930s, through the 1960s and 1970s learned their craft from Kenneth Bates.

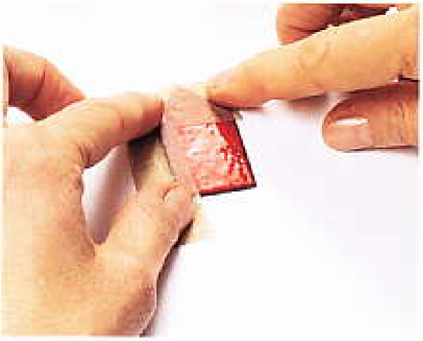
Kenneth Bates *Plaque with Trees*, 1993. 9 x 9¼ in. (22.9 x 23.5 cm). Copper, enamel. Photo by Bernard Jazzar.

Top: Melissa Walter *Close to Home*, 2003. 12 x 1½ x ¼ in. (30.5 x 3.8 x .6 cm). Silver, copper, enamel. Photo by Linda Darty.

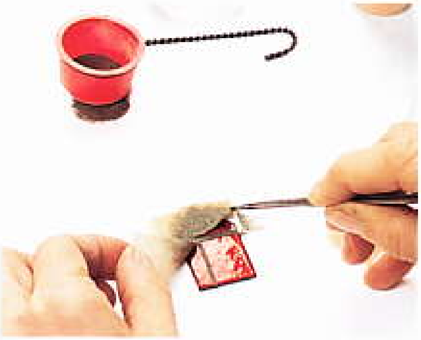
Center: Gretchen Goss *Gesture and Ornament #1*, 2001. 12 x 12 in. (30.5 x 30.5 cm). Copper, enamel. Photo by artist.

Bottom: Earl Pardon Untitled, 1986. 4½ x 1¼ in. (11.4 x 3.2 cm). Sterling silver, fine silver, 14-karat yellow gold, 24-karat yellow gold, amethyst, aquamarine, London blue topaz, enamel; fabricated. Photo by Tod Pardon.

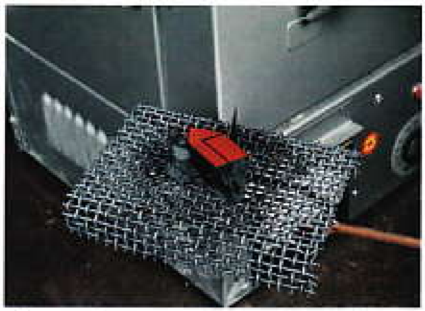
free, but other papers or cloth may also work well.)



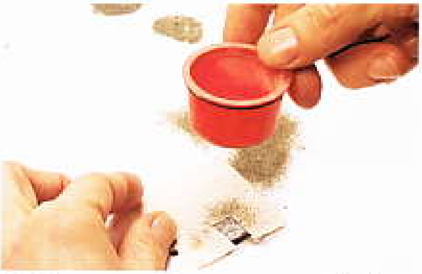
2. If you want to create a design with hard, crisp edges, soak the stencil in a dish of water. Squeeze out the excess water, and apply the wet stencil to the clean copper or enameled surface as shown.



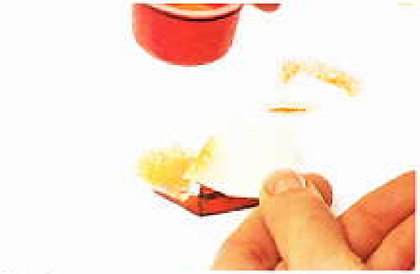
3. Thinly and evenly sift the powdered enamel color of your choice over the stencil. Pick up the stencil with tweezers (see photo), or let it completely dry before removing it. If the stencil is too wet or otherwise difficult to lift off the piece, sew a stitch of thread through it so you can lift the thread and easily remove the stencil.



4. Let the enamel completely dry, and then fire the piece.

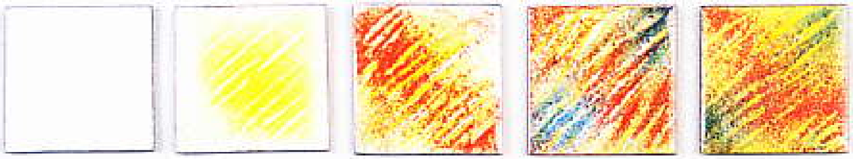


5. If you want the next stenciled layer to have softer edges, sift the enamel over a dry paper towel.



6. If you want an even softer edge, raise the stencil off the piece when you sift a new enamel layer.

The samples below by Mi Sook Hur show the effects of sifting in layers using a paper stencil with transparent and opaque enamel colors.

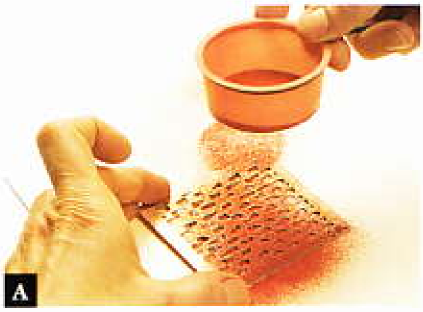


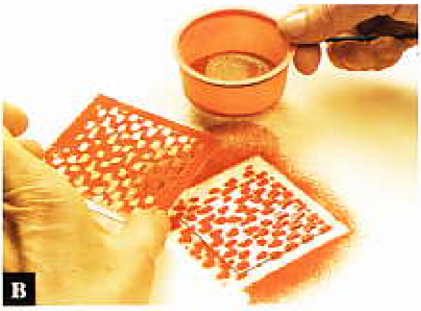
Right: Rebekah Laskin *Brooch*, 1987. 2⅛ x 2⅜ in. (5.4 x 6 cm). Enamel, copper, sterling silver. Photo by artist.

Far right: Barbara Minor *Red & Black Marquis Pin*, 2001. 4 x 2 in. (10.2 x 5 cm). Copper, silver, fine silver, onyx, enamel. Photo by Ralph Gabriner.

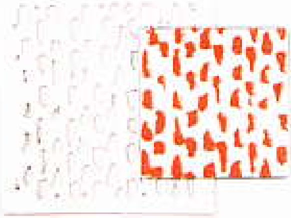
Patterned Stencils

In addition to creating shapes and textures, you can create patterns with found or handmade stencils. Barbara Minor created the following samples using only one color to show how a stencil creates pattern. On a finished piece, the stencils would be used with multiple transparent or opaque colors in numerous firings. The finished pieces could include patterns that can be seen through transparent colors, with layers of other patterns which overlap the design beneath them.

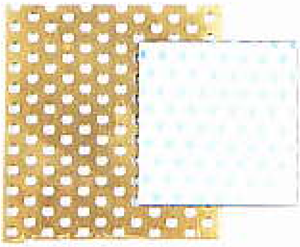




This stencil is a copper sheet with etched perforations (photo A). 100-mesh red enamel was sifted through it onto a base coat of white enamel (photo B).



This is the patterned stencil piece after one firing.

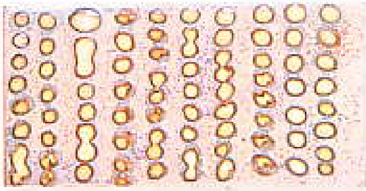


Another idea for a patterned stencil is a found piece of perforated brass screen. The color was sifted onto a base coat of white enamel.

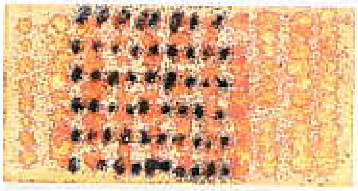
Patterned Stencils on Copper with Firescale

If you sift enamel through a stencil onto bare copper you can create firescale patterns. Once you fire the piece, you can sift more layers of enamel through the same stencil, firing between siftings. If you use an enamel with a high acid resistance (most lead-free colors) for at least the first sifting, you can clean parts of the piece in pickle to control the amount of firescale left on the piece before the final transparent overcoat. To produce the reddish copper color shown in the samples below, leave more firescale beneath the transparent flux. To produce the golden clear color, fire the clear enamel very hot over very clean copper.

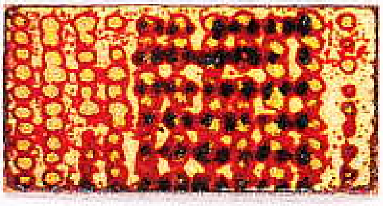
These test pieces by Jessica Turrell investigate the effects of firescale used with sifting techniques.



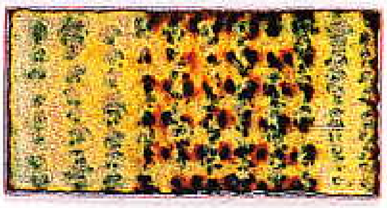
For this sample, clear enamel (flux) was sifted through a stencil made of metal with drilled holes and fired. The metal was cleaned in a pickle bath.



This sample shows black enamel sifted onto the piece through the same drilled metal stencil and fired. The firescale was left on the surface.



Clear enamel (flux) was sifted over the firescaled surface and fired.

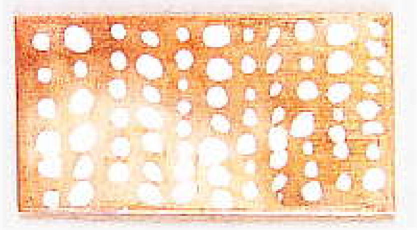


The piece was fired at a higher temperature so the copper oxide would affect the color of the clear enamel.

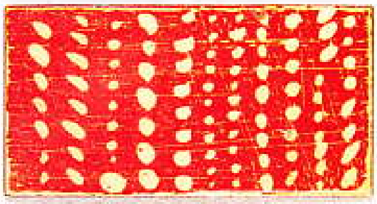
Stenciled or Painted Pattern Using Firescale with Sifting

The following samples show Jessica Turrell's continued experiments with patterning and firescale. Ball clay or Scalex can be used for the technique.

Ball clay was painted on the copper to act as a resist and allowed to completely dry. The piece was heated to create a firescaled surface on the exposed copper. Clear enamel was sifted over the entire surface (the ball clay and the firescale) and the piece was fired. After firing, the enamel could be removed from the places where the ball clay was applied, revealing clean copper. Clear enamel was sifted over the entire surface. When fired, the clear enamel appears bright gold over the clean copper and reddish brown over the firescale.



Paint or stencil ball clay onto a clean copper surface, and let dry.



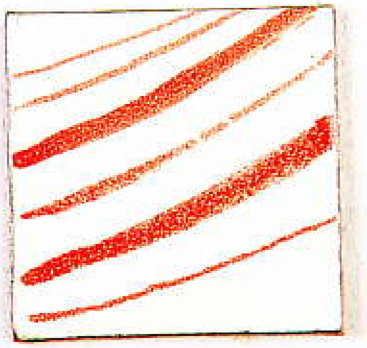
Fire the piece in the kiln until firescale appears on the uncoated copper. After removing the piece from the kiln, apply clear enamel over the entire surface of the metal and fire it again. Flake off the ball clay resist and the clear enamel covering it to reveal areas of clean copper. Rinse the metal. Sift clear enamel over the entire surface and fire until fused. The areas once covered with ball clay will be shiny and bright. The areas coated with firescale will appear reddish brown.

SIFTING & DUMPING

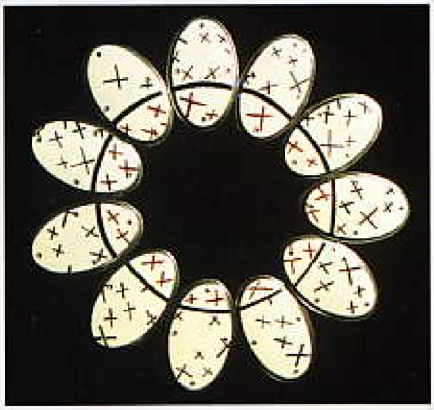
To begin this technique, you'll need a piece of metal with a clean surface or a fired basecoat. You apply a holding agent or adhesive to the metal, sift on a coat of dry enamel, and tap off the excess powder. Once the piece is completely dry, fire it. Experiment with this technique: consider forming fine lines, large shapes, dots, patterns, and even lettering. In addition to common enamel holding agents, consider using glycerin, oil binders, stamping ink, or fiber-tipped marking pens to hold the enamel in place. Some brands of pens are more suitable for this task than others, so experiment to determine which ones stay wettest and hold the powder best.

Depending on the degree of detail in your design, 200-mesh enamel may be the best size to use. (Remember that finer glass particles cling more easily to the detailed lines.) Prepare the enamel and have it in the sifter before you apply the holding agent to the piece. You need to be able to quickly sift the enamel over the design before it dries.

Created by Sarah Perkins, the following samples of the sifting and dumping technique illustrate some of the detailed lines and patterns you can make.

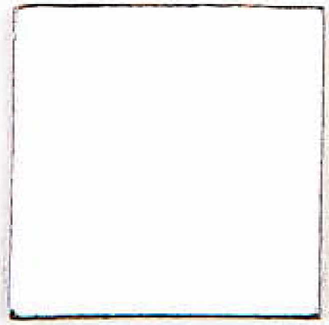


This sample shows the variety of line widths you can create using different binders. An opaque ivory base coat was fired on the metal. Lines were drawn on the base coat with different size felt-tip markers, with gum binder on a paintbrush, with water on a paintbrush, and with thinning oil on a crow quill pen. 200-mesh opaque red enamel was sifted on top of the lines, the excess powder was tapped off, and the piece was fired until fused.

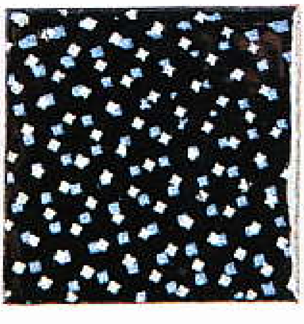


Right: Gretchen Goss *Coreopsis,* 2000. 16 x 20 in. (40.6 x 50.8 cm). Copper, enamel. Photo by artist.

Far right: Sarah Turner *All For One Buckles,* 2002. 3 x 2 in. (7.6 x 5 cm). Copper, sterling silver, enamel. Photo by Courtney Frisse.

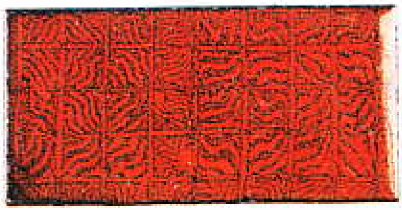


In this sample, an opaque ivory base coat was fired on the metal. Hand cream was rubbed onto a fingertip. The greased finger was printed onto the base coat. 200-mesh opaque blue enamel was sifted over the fingerprint, and the excess powder was tapped off. The piece was fired until fused.

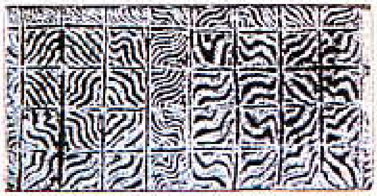


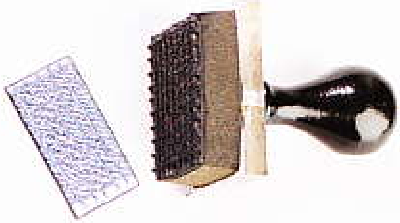
For this sample, a rubber stamp was used with embossing fluid to make a pattern over an opaque black base coat. 200-mesh opaque blue enamel was sifted over the pattern, the excess powder was tapped off, and the piece was fired. Embossing fluid was stamped again in a different place on the piece, and 200-mesh opaque yellow enamel was sifted on the pattern. The excess powder was tapped off before the piece was re-fired.

To create the samples below, Elizabeth Turrell used a hand-cut stamp with ink from a regular office stamp pad. Immediately after stamping the ink, 200-mesh enamel was sifted over the whole piece. The piece was picked up, tapped sharply to remove the excess enamel, and dried for a few minutes before firing.



Here's the sample with opaque black enamel sifted over a red base coat, and fired. The sample above right used the same technique, but opaque white enamel was sifted over a black base coat, and then the piece was fired.





A hand-cut stamp was used to make the pattern.

SGRAFFITO THROUGH SIFTED ENAMEL

Sgraffito is an Italian word that describes the technique of scratching through a layer of something to expose what is beneath it. Potters scratch through glazes or slips to expose clay, and painters use sgraffito to expose other layers of paint. On page 99 you'll learn about sgraffito with liquid enamel, an especially nice technique that can result in very fine and delicate scratch lines. When combined with stenciling or other

Left: Sarah Krisher *Complicating the Simplified Series,* 2003–2004. 12 x 12 in. (30.5 x 30.5 cm). Enamel, copper. Photo by Robert Muller.

Center: Jan Baum *100% Pure,* 1999. 2¾ x 1⅜ x 13/16 in. (6.9 x 3.5 x 2 cm). Sterling silver, copper, enamel, found object.

Right: Julie Brooks Price *Two of a Kind-Male,* 2001. 1¼ in. (3.2 cm). Silver, copper, enamel. Photo by Linda Darty.

sifting techniques, however, sgraffito can be very effective for creating textured surfaces. You can scratch a design through any enamel color to expose either the metal beneath it or a previously fired enamel layer. To scratch through unfired enamel, you can use many tools, such as needles, toothpicks, or any other sharp pointed instruments. For removing larger areas of color, you can use paintbrushes, erasers, or even your fingers.

How to Sgraffito Sifted Enamel

Before You Begin

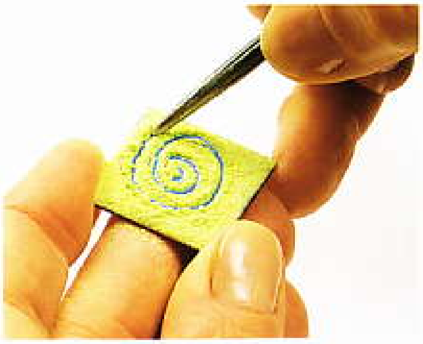
- Position a clean piece of paper beneath the work to catch extra enamel so you can reuse it.

- Wear a dust mask so you won't inhale any enamel powder while you're scratching it away.

- If your design is going to be very precise, with fine lines, prepare 100-mesh or 200-mesh enamel.

1. If the piece you want to sift requires the use of a holding agent, apply it with a paintbrush or sprayer.

2. Sift the enamel onto the metal. If used, let the holding agent dry.



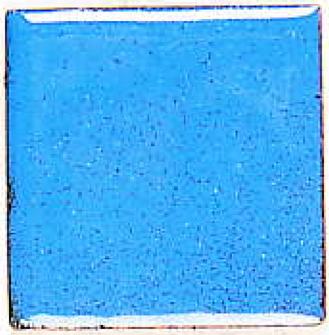
3. Scratch away lines or areas as desired. Blow or brush the excess enamel onto the clean catch paper.

4. Fire the piece until the enamel fuses.

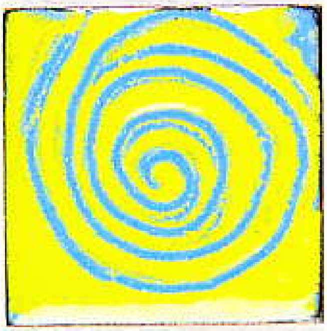
In the photo to the right, sample A features a fired bright blue opaque base coat.

On sample B, a second coat of lime green enamel was sifted over the bright blue. A sharp tool was used to scratch a line through the lime green enamel to reveal the blue base coat.

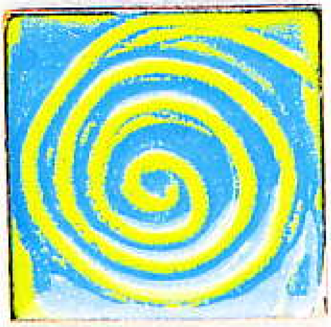
Sample C shows the same sgraffito process executed in reverse. Bright blue enamel was sifted over lime green, and then scratched through to reveal the base coat.



A



B



C

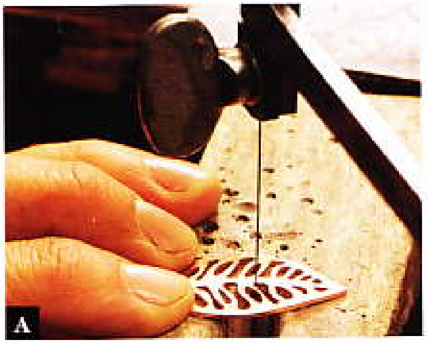
Left: Linda Darty *Outside In: Vase*, 2002. 6 x 5 x 4 in. (15.2 x 12.7 x 10.2 cm). Copper, sterling silver, enamel. Photo by artist.

Right: Renee Menard *Landscape I*, 2002. 11 x 14 in. (27.9 x 35.6 cm). Copper, enamel. Photo by Helen Shirk.

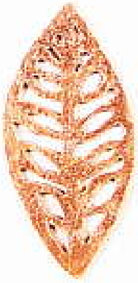
Far right: Linda Darty *Outside In: Cup*, 2002. 6 x 5 x 4 in. (15.2 x 12.7 x 10.2 cm). Copper, sterling silver, enamel. Photo by artist.

Pierced Piece Using Simple Sifting

The simple sifting technique is also very effective on pierced copper. When designing a piece, keep the pierced sections small and connected with varying line widths of metal. Without support, the enamel is more likely to chip off very fine lines and very long lines. Carefully draw your design directly on a metal piece, draw it on tracing paper and adhere it to the metal with rubber cement, or use any other transfer method you prefer. (When using rubber cement, apply it to both the metal and the paper, let it dry on both surfaces until tacky, and then adhere the two pieces. If you don't use this method, your drawing could slip while you're sawing out fine lines.) When sawing fine lines on metal you wish to enamel, select metal that is at least 22- gauge thick. (Enamel is likely to crack or chip off thinner sawn metal.) It's easiest to saw very fine lines if you use a size 4/0 or 5/0 blade. Since 100-mesh or 200-mesh enamel will more easily adhere to fine lines, use graded sifters to remove larger particles of enamel. You'll later use this same piercing technique to create champlevé and plique-à-jour pieces.

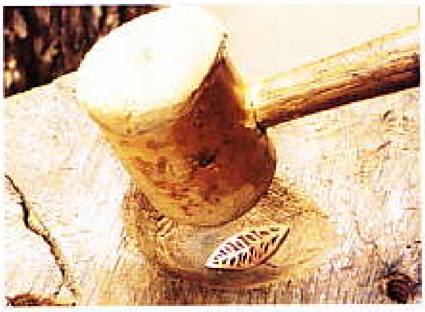


A

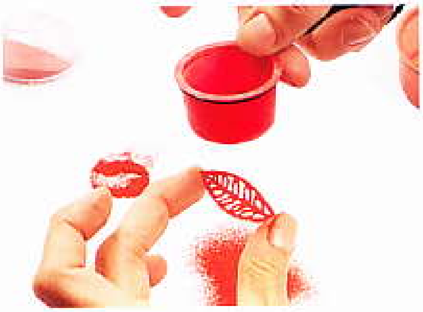


B

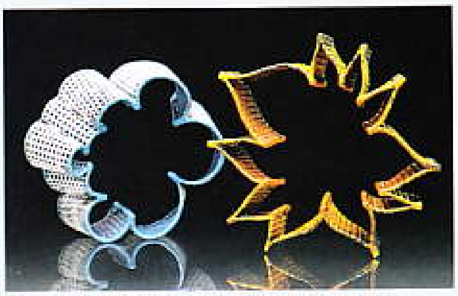
1. Drill a hole in the metal for each pierced area of your design. Insert the saw blade through one hole and saw out the interior shape (photo A). Repeat this process to saw out all shapes (photo B).



2. Form the pierced metal piece to give it strength, lessen the possibility of it warping, and decrease the chance of the enamel cracking or chipping off the surface.



3. To help prevent the delicate piece from warping, you'll fire both the base coat and the counter enamel on the pierced metal at the same time. Paint a holding agent on the back side of the clean metal and sift on the counter enamel. Lightly spray a holding agent over the counter enamel. Holding the piece by its edges, turn it over to work on the front side.

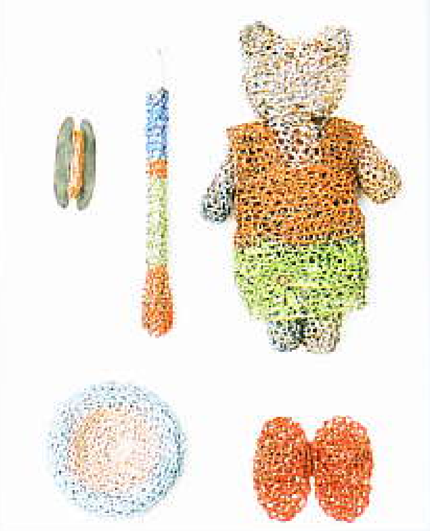


Top: Masumi Kataoka *Where It Ages Like Tree Rings #1*, 2002. 10 x 8 x ½ in. (25.4 x 20.3 x 1.3 cm). Sterling silver, copper, enamel, nylon, wood; fabricated, electroformed. Photo by artist.

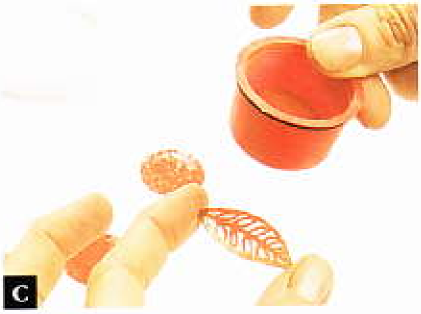
Center: Jan Baum *Fountain Flower #2*, 2003. 2½ x 2½ x 5/16 in. (6.4 x 6.4 x .8 cm). Steel, enamel. Photo by Norman Watkins.

Center: Mary Chuduk *Tea Strainer Teapot*, 2002. 8 x 12 x 6 in. (20.3 x 30.5 x 15.2 cm). Copper screen, liquid enamel; sprayed, formed, kiln fired. Photo by Jeff Scovil.

Bottom: Natalya Pinchuk *Bracelets*, 2003. 4½ x 4½ x 2 in. (11.4 x 11.4 x 5 cm) each. Copper, silver plate, enamel. Photo by artist.



Esther Knobel Display from the series *My Grandmother is Knitting Too*, 2002. 6¾ in. (17.1 cm). Copper, enamel; knitted. Photo by Vered Kaminski.



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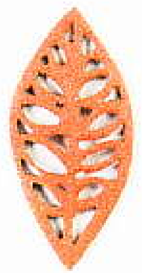
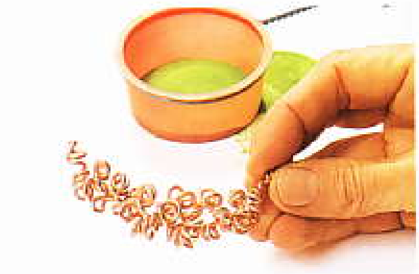


D

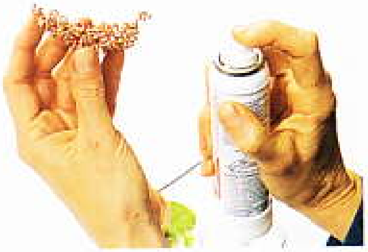
4. Spray a holding agent on the front side of the pierced piece, and then sift on a base coat of 100-mesh or 200-mesh enamel (photo C). Place the metal on the firing trivet with the top side facing up, and allow it to thoroughly dry. Fire the pierced and sifted piece until the enamel fuses. A second coat of enamel was sifted on the fused base coat and underfired to "sugar" coat the surface (photo D).

SIMPLE SIFTING ON WIRE FORMS

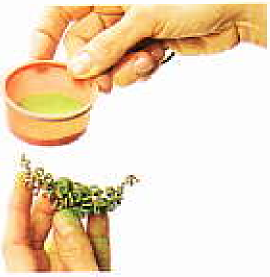
In addition to simply balling up wire, you can twine it, knit it, weave it, crochet it, and use many other exciting textile techniques. You can create wire projects to enamel in copper, steel, or fine silver. It's simple to enamel wire forms. A properly applied holding agent will help dry enamel adhere to the wire. Because smaller grains more easily cover wire shapes, it's most effective to use 100-mesh or 200-mesh enamel. You also can use liquid enamel to create interesting tonal effects in the high and low areas of wire structures. (See page 97 for more information on liquid enamel.)



The original wire form



Spraying a holding agent on the wire form



Sifting enamel on one side of the wire form

Spraying holding agent over the sifted enamel

Sifting enamel on the reverse side of the wire form

The sifted and fired wire form supported on a screen

The enameled wire form

FAST FACTS & HELPFUL HINTS

— Always wear a high-quality dust mask when sifting so you won't inhale the airborne glass particles that are invisible to your eyes. If you plan to sift a lot, you may want to purchase an air purifier and place it on a table near your sifting area.

— Sift enamels at a 90-degree angle to the surface of a piece. If needed, adjust the angle of the metal, not the angle of the sifter.

— Clean sifters by sharply tapping them against a table edge. Do this each time you change enamel colors.

— Clean very fine mesh sifters with a pressurized air sprayer (commonly used for cleaning computer keyboards). You can purchase one at an office supply store.

— Sift over two clean magazine pages or copy paper sheets. (It's easier to pour enamel off a slick, glossy paper than newsprint.) The bottom layer keeps the back side of the top sheet clean. When you use the top sheet as a funnel to return excess enamel to its container, no dirt will fall into the container and contaminate the enamel.

— To lessen enamel dust in your studio, fold used catch papers twice before disposing them in a waste receptacle.

— When sifting several enamel colors on one piece for a single firing, arrange different sifting stations and assign a different color and sifter to each station. As you work, walk to the different stations to sift different colors onto the piece. If you follow this procedure, you won't have to put the piece down, and you won't contaminate the colors.

— Use 100-mesh to 200-mesh enamel when sifting intricate shapes or thin lines. The smaller grains of glass more easily attach to the fine detail.

— Use 80-mesh or larger enamel particles if you want transparent colors to be very bright and clear.

— Apply a holding agent to three-dimensional shapes before sifting. If needed, you can spray on the binder after sifting to "glue" the enamel grains in place. This top coat allows you to turn a piece over and sift the other side.

— Frequently damp wipe the surfaces in your studio!

Painting Techniques

Right: Barbara McFadyen *Brooch*, 2000. 2 x 1½ x ⅜ in. (5 x 3.8 x .9 cm). Copper, gold, enamel. Photo by Ralph Gabriner.

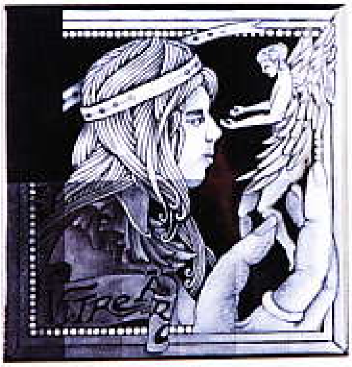
Far right: Martha Banyas *Brooch*, 1987. 2¼ x 2¾ in. (5.7 x 6.9 cm). Copper, silver, enamel. Photo by artist.

IT IS MY OPINION that of all the enameling techniques, painting with enamel requires the most skill and control. In this case, I am referring to painting with vitreous enamel, blending the ground glass in layers using opaque and transparent colors, to create tonal and color variations. Historically, this technique has been referred to as Limoges because it was in the city of Limoges, France, that the technique flourished in the 15th and 16th centuries. Studying these historical enamels in museums is for me a breathtaking and humbling adventure. The way the artists skillfully painted with glass is indeed impressive, and becomes even more so when you realize they were building and firing in wood-burning furnaces and making their own glass! Comparatively few contemporary enamelists paint with glass with the same detail and skill that was typical of true limoges enameling. If you practice blending and layering transparent glass, you'll be able to execute other wet inlay enameling techniques, such as cloisonné, champlevé and plique-à-jour, with greater control.

There are many simple ways for contemporary enamelists to work with painterly techniques because of the variety of new materials available commercially. Read this whole chapter before trying these techniques: it's essential that you clearly understand the differences between underglazes, regular enamel, (which in this case, refers to the vitreous glass we use for sifting) and overglaze painting enamels (which also include china paints called vitrifiable enamels, since they do not become vitrified glass until they fuse with heat). You can use these materials separately or in combination with each other, but you must first understand the application and firing procedures for each.

PAINTING WITH ENAMEL

Wet-inlaying regular powdered enamel was discussed on page 33 as a method of applying base coats or counter enamels. Painting with enamel is also a wet technique, done in a more painterly manner, blending and shading many thin layers of color to build value and dimension in the finished work. I'll begin by explaining the grisaille technique, which was really the first type of enamel painting, done so beautifully by the artists in Limoge during the 15th century. *Grisaille* comes from the French word *gris*, meaning gray, and grisalle enamels are primarily made up of gray tones. Limoges enamelists working in grisaille may have drawn their graphic inspiration from the portfolios of prints and illustrated books that were common at the time. They even shared their main drawing tool, the scribe, with printmakers.



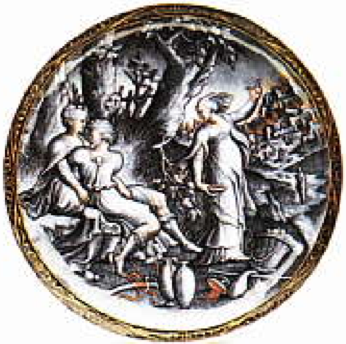
Harold B. Helwig created this 6 x 6-inch (15.2 x 15.2 cm) sample shown above. He divided it into sections to show you the layering process for making a grisaille enamel. The first step is in the upper left hand corner. Following the sample counter clockwise, there are 11 individual coats of enamel added until the final finished section is complete. Look carefully as you move around the piece, and you'll notice that the gray values become lighter and lighter with each coat of white painting enamel.

Painting a Grisaille Enamel

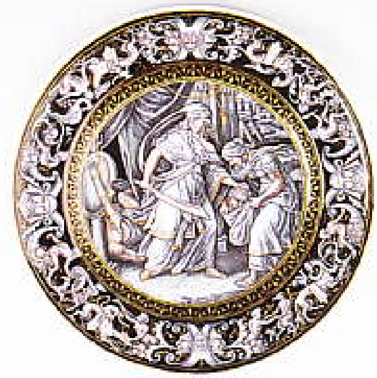
1. Counter-enamel a metal piece. Sift and fire on a base coat of black enamel.

HISTORICAL HIGHLIGHT

Long before the painting technique named after Limoges, France, was developed, the city's artisans had already developed a reputation for fine metalworking, goldsmithing, and champlevé enameling. In medieval champlevé, the areas to be enameled were scooped out of the metal and the depressions were filled with glass, as you can see in the Processional Cross on page 115. Though the same materials were used, the term "painting" is more descriptive of the technique that was developed in the 15th century and is now described as Limoges enameling. The outlines and areas of color were applied with a brush and spatula, and fused in layers in a series of firings. The technique was very painterly, and the artists who worked this way may not have originally worked as goldsmiths or metalworkers. It is thought that painting with enamel may have been discovered by accident when a monk experimenting in his workshop applied enamel to the surface of a piece without metal partitions, fired the piece long enough for the glass to fuse, and discovered that the colors did not run together. Limoges artists also discovered that applying a coat of enamel on the reverse side of an enameled piece prevented warping and cracking of the enamel on the front side. In the 15th century, Limoges artists first worked in the Grisaille technique, making pieces that were miniature paintings, usually with religious themes.

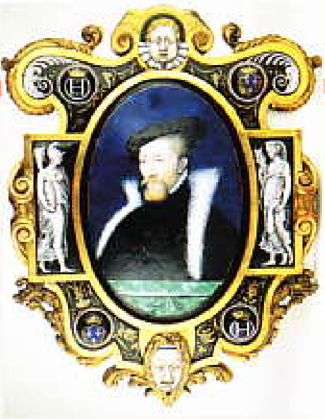


Workshop of Pierre Reymond *Standing Dish with Lot and His Daughters*, mid-16th century. $3\frac{1}{2}$ x $9\frac{7}{16}$ in. (8.9 x 24 cm). Enamel, copper. Bequest of Charles Phelps and Anna Sinton Taft, Taft Museum of Art, Cincinnati, Ohio.

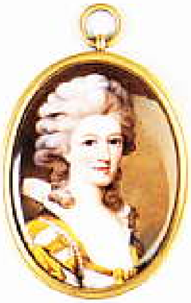


Grisaille enamel plate, late 1700s. $8\frac{1}{2}$ in. diameter (21.6 cm). Enamel. Courtesy of W. W. Carpenter Enamel Foundation. Photo by Keith Wright.

The enamel workshops in Limoges were family businesses and the art was passed down among generations. Leonard Limosin, Jean Penicaud, and Pierre Reymond were some of the most skilled masters at Limoges enameling. Most of the early enamellists looked at illuminated manuscripts, illustrated books, religious paintings, sculpture, and stained glass windows as source material for their designs. During the late 15th and early 16th centuries, the work of these enamellists gradually moved away from religious subject matter, and included portraits and narrative secular pictures. Leonard Limousin created some of the most beautifully rendered portraits ever executed in enamel. He was a painter and an engraver as well as an enamellist.



Léonard Limosin *Portrait of François de Clèves, duc de Nevers*, mid-16th century. $17\frac{3}{4}$ x 12 in. (45.1 x 30.5 cm) image; 29 x 23 in. (73.7 x 58.4 cm) framed. Enamel, copper, wood. Bequest of Charles Phelps and Anna Sinton Taft, Taft Museum of Art, Cincinnati, Ohio.



William Russell Birch *Lady Russell*, 1783. $2\frac{1}{2}$ x $1\frac{9}{10}$ in. (6.3 x 4.8 cm). Enamel. Courtesy of W. W. Carpenter Enamel Foundation. Photo by Keith Wright.

William Birch was born in England in 1755 and moved to America in 1794 where he continued to enamel. If he was not the first artist to enamel in America, he was certainly one of the first. Unlike the earlier work of Limousin which was painted with regular enamel, these portraits were painted over the enamel base coat using what we now call "painting enamels", or finely ground ceramic pigments mixed with glass that become vitrified when fired.

A Short Pink-Ground Enamel Bodkin Case, circa 1765. $4\frac{1}{8}$ x 1 in. (10.5 x 1 cm). Enamel. Courtesy of W.W. Carpenter Enamel Foundation. Photo by Keith Wright.

2. Sift a thin layer of 150-mesh opaque antimony white enamel onto the base coat, and let it dry. (Different white enamels are made with different materials. Antimony white works best for the grisaille technique.) Scratch through the white enamel as needed to reveal the lines or areas you want to remain black. Blow or brush off excess.

3. Wet-milled white enamel is finely ground with water in a ball mill. If you prefer, you can mix this type of enamel with water and a holding agent or an oil binder. Simply let the binder soak into the glass. (If you stir the enamel mixture you'll create air bubbles.) This special type of enamel is sold commercially as "grisaille white," or you can also make your own. You'll need it for the next step.

4. Using a fine sable brush, paint the white grisaille enamel on top of the base coat in very thin layers to lighten the gray values. Fire the piece between layers. Subsequent applications and firings yield lighter values until pure white is reached in some areas (if desired). Firing the early painted layers very hot will soften the edges of the design and help the white fuse with the black to create gray values.

5. Paint the final details of your composition with a mixture of 325-mesh white enamel and a holding agent or oil binder. Fire this layer just long enough to fuse it.

Camaieu

Camaieu describes a painting technique very similar to grisaille enameling. Camaieu was more prevalent in the latter part of the 16th century. In this technique, painted layers of white enamel are built up on a transparent colored surface instead of a black one. Harold B. Helwig created these samples to show different stages of painting camaieu and impasto enamels.

Painting a Camaieu Enamel

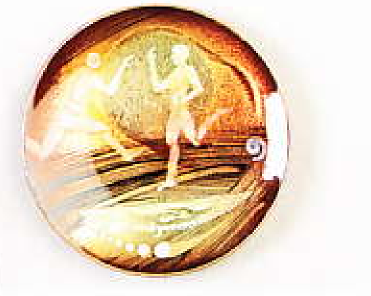
- (photos A, B, and C) Apply antimony white wet-milled painting enamel to build up the white areas. The first application and firing may seem to almost disappear. Paint a second coat of white enamel onto the piece. This step will reveal the first white coat. Repeat the process to apply at least four additional coats of white painting enamel.

Impasto

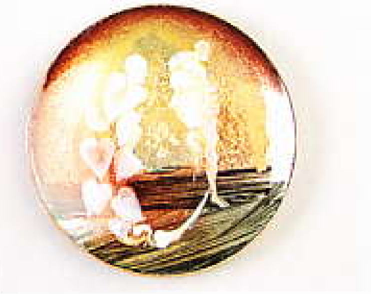
- The impasto painting technique eliminates the need for so many firings. By painting the white enamel directly on the copper surface without a base coat beneath it, you can build up the layers more dimensionally in only one firing. (If you apply enamel this thickly and unevenly on top of a base coat, it would likely crack.) You can sift a transparent color over the white painting, and then apply successive layers of white enamel as desired.

Painting an Impasto Enamel

- (photos D and E) Soak antimony white enamel in a solution of one part holding agent and two parts water. Use a paintbrush to apply 325-mesh antimony white enamel to a clean copper surface. Sculpt the enamel in low relief, and let dry. Fire the enamel for 1½ to 2 minutes at 1470° F (799° C) until it is just attached. Do not over-fire the piece or bring it to a full gloss. Apply a black underglaze to the exposed copper surface. Cover the underglaze with a coat of transparent enamel, and fire the piece. Counterenamel to finish.



A



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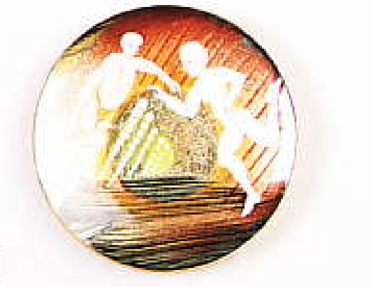
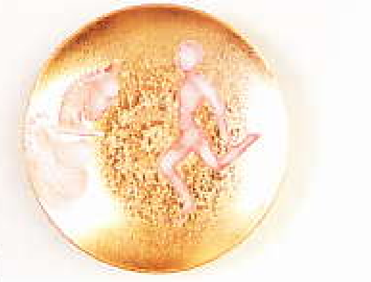
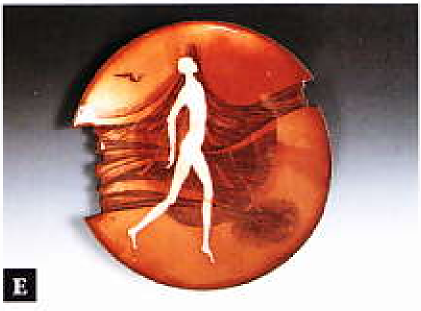


C



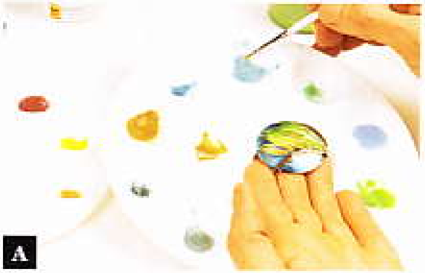
D



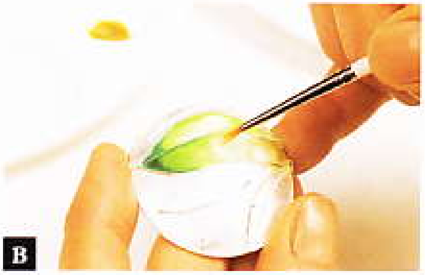
E

BLENDING COLORS WHEN PAINTING WITH ENAMEL

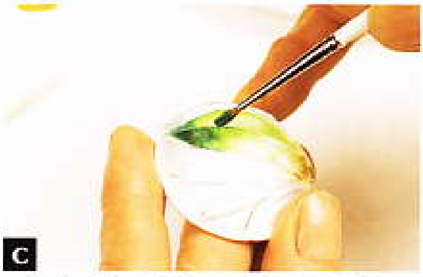
You can directly blend enamel colors into each other or use water and a small sable paintbrush to blend and fade them. You'll use the same painting technique described below to blend transparent colors for limoges, cloisonné, or champlevé pieces. (This sample piece has cloisonné wires outlining the design.)


A

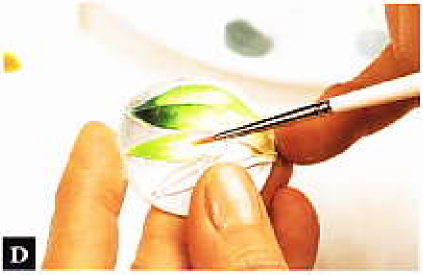
- If the enamel is the correct consistency when applied, evenly blending two or more colors is not difficult. If the colors are too dry, they tend to clump up on the surface in lumps. If they are too wet, they will wash or spill across the surface. By tilting the paint tray as shown in photo A, you can pick up dryer or wetter enamel, depending on your needs.


B

- When blending together two enamel colors, I suggest blending the light color into the dark one (photo B). Repeatedly move the paintbrush up and down, pushing the grains of glass until you're satisfied with their appearance.

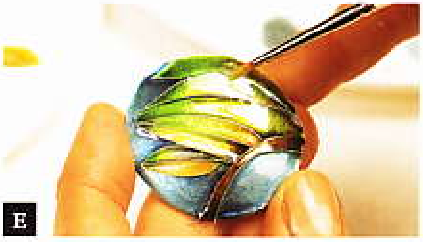

C

- If the blend doesn't look right, pick up more of the dark or the light color and continue dabbing it into the mixture (photo C). Grains of glass don't mix like paint, but they will mix visually as they lay beside each other.


D

- You can blend a single color from light to dark by adding water to thin it as shown in photo D.

- It isn't necessary to cover an entire piece with enamel before each firing. Work on specific areas and fire them to see if you're getting the value and color range you desire. Proceed to add value or color, depending on the results.


E

- Thinly layer opaque, translucent, or transparent colors to create a painted enamel piece or cloisonné, as shown in photo E. Dry and fire the piece between layers until you're satisfied with the results.

- Don't blend wet enamel colors into areas that are already dry. This causes a separation known as *shore-lining*, a flaw that looks similar to the line formed in the sand when the tides move in and out on the shore.

F

- Let the enamel dry well before firing.

Right: Martha Banyas *All We Are and All We Seem*, 1983. 26 x 40 x 5 in. (66 x 101.6 x 12.7 cm). Copper, brass, wood, enamel. Photo by artist.

Left: April Higashi *Community*, 2000. 3 x 2 x ¼ in. (7.6 x 5 x .6 cm). Sterling silver, 24-karat gold leaf, enamel. Photo by George Post.

When enamel colors dry they look chalky (see photo F), and you may think they aren't blended well, but remember how the colors looked wet and confidently fire the piece.

- When painting with standard enamel (regardless of mesh size) and blending colors, make sure the enamel is wet enough to easily move around the surface of the piece. If it seems to be clumping and not shading or blending easily, add a bit more water.

- It may be simpler to shade with 200-mesh or 325-mesh enamel, but to achieve the greatest transparency I suggest using the same painting techniques with 80-mesh enamel. When working over silver, gold, or textured metal, you should have no problems blending and shading an 80-mesh color.

- You'll have difficulty blending if a color is too saturated, such as a deep cobalt blue or a red. The grains of the deep color are always visible as specks in the lighter one. I reserve saturated enamel colors, apply them in their own firing, and don't often try to blend them with other colors. I do blend with saturated color, but only by using water to shade and change their value. If I want to blend another color into a dark saturated color, I blend it during a separate firing.

WATERCOLOR PAINTING ENAMELS & ACRYLIC PAINTING ENAMELS

Woodrow Carpenter, owner of the Thompson Enamel Company, invented enamels that look and feel like watercolors, acrylic paints, and wax crayons. You can use these wonderful new materials in combination and with regular 80-mesh enamel. If you're familiar with other drawing and painting media but have never enameled before, you can quickly take advantage of these products—the only thing you need to learn is firing!

Note: If you're losing the reds and yellows when firing watercolor or acrylic enamels, you're probably firing too hot or too long.

Watercolor Enamels

Mi Sook Hur learned to enamel on the sample in photo G using watercolor enamels. Watercolor enamels are composed of finely ground enamel suspended in a water-soluble base. To use watercolor enamels, wet a soft paintbrush with water and mix the color to a consistency you like. You can mix these enamel paints together on a watercolor tray just like ordinary artists' watercolors. Thinly apply the paint over a light or white base coat. For best results, fire many layers of color from light to dark to build up the values in the painting. If you apply them thinly and fire them correctly, the colors will be transparent, but you can also apply them more opaquely, depending on the effect you desire.

G

Cloisonné

Fay Rooke *Gift of Time,* 1988.
28 x 25 x 3.2 cm. 24-karat gold and fine silver cloisonné wire on raised, pierced copper base with plique-à-jour enamel. Photo by Terry Roberston.

CLOISONNÉ IS PROBABLY the most easily recognized enameling technique, and in fact, when I tell people that I'm an enamelist, one of the responses I often hear is "Oh yes, I know enameling, it's that technique that has all the little wires on the surface!" Cloisonné has a rich and long history, and because there are so many imported Chinese and Japanese items available for consumers to purchase, it's the technique most people identify as enamel work.

Cloisonné is a French word meaning "to be cut off." It describes a technique that utilizes thin ribbons of wire to separate areas of enamel color. Rather than soldering the wires to a metal base, as was the practice in Byzantine times, contemporary enamelists most often adhere the wires by fusing them into a previously fired coat of enamel. The design is arranged on the enameled surface with the flat wire standing on its thin edge, perpendicular to the piece and "glued" in place with a gum binder. Once the binder has dried, the piece is fired so that the wires barely sink into the base coat of enamel. Various colors of transparent, opaque, or opalescent enamels can then be inlayed around the wires and fired in layers until the glass is flush with the top of the wires. If you wish, the piece can be ground level and re-fired for a glossy surface, or sanded and hand polished to a matte finish.

CLOISONNÉ WIRE

Although you can make your own cloisonné wire, various gauges of wire in different heights and thicknesses are available commercially. Shorter wire (about 20 gauge) will result in a thinner finished coat of enamel. Taller wire (18 to 16 gauge) will require more layers of enamel in order to fill the cloisons, (but it also allows more opportunity for shading and layering color). Even wire of different thicknesses can be used in the same piece, and a thicker piece of wire can be hammered or milled through a roll mill so that when seen on the finished enamel, it will subtly change in quality, like a pencil line that goes from light to dark. Thin wire is usually about 34 to 36 gauge and thicker commercial wire is about 26 gauge. The wire can be formed with the fingers, pliers, tweezers, or around a jig to create a pattern or design that can include detailed cell-like areas, or simply open, linear designs. Fine gold or fine silver wire is most often used for cloisonné work, but copper or brass wire can also be used if you don't mind dealing with the firescale that will form between firings. Copper wire is nice because it will oxidize to a black or dark color if you dip the piece in a liver of sulphur solution after it's finished.

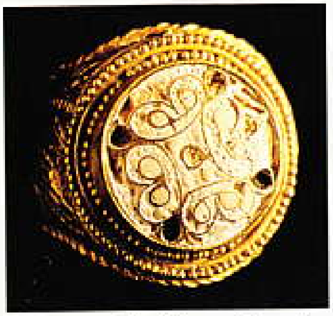
A

SELECTING THE BASE METAL

Depending on how the piece will function, its size, and whether it will be formed or not, choose a base metal for jewelry size pieces that is anywhere from 24 to 18 gauge, and thicker gauges for larger pieces. Thinner gauges will need to be formed a little for structural strength to prevent warpage and cracking. Because it's more difficult to form the wires over a curved surface, a beginner might want to leave the piece flat, work on 18-gauge metal, or perhaps form a thinner gauge piece just minimally. If the design doesn't include very long lines, it's not difficult to form cloisonné wires over a domed surface.

HISTORICAL HIGHLIGHT

Cloisonné may have been the first enameling technique developed, long before others. In 1952, British archeologists excavated tombs in Kouklia, a small village in southwest Cypress that was an ancient city of wealth and importance in the late Byzantine Age. In one of the tombs, the archeologists found six gold rings decorated with cloisonné enamel that appears to have been fused.

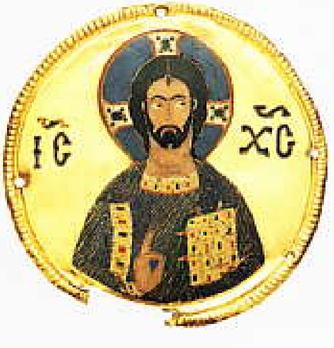


Gold Ring with Cloisonné Enamel, 13th Century B.C. One of six rings discovered in a Mycenaean tomb at Kouklia, Cyprus in 1952. The earliest findings with cloisonné enamel in existence. Courtesy of Dr. Panicos Michaelides.

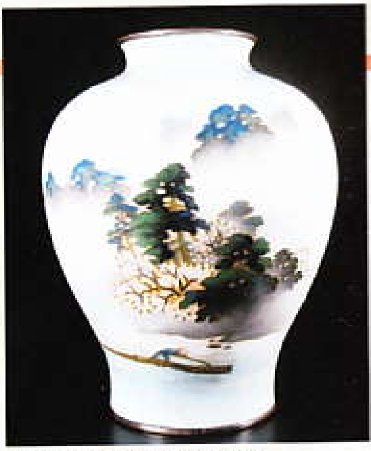
The very early use of cloisonné wires may have been inspired by the goldsmiths' familiarity with making enclosures for jewels out of soldered metal strips. When it was difficult to import various stones from far across the seas, metalworkers may have devised another method of including color by using glass. It is also quite possible that they thought the wires kept the glass from spreading, although with the glass available and the primitive firing methods, the early artisans had a difficult time even getting the enamel to gloss, much less spread very far! The wire cloisons probably did prevent the glass from cracking or chipping by dividing the piece into smaller enamel sections, adding strength to the metal, and reducing warpage.

Above: Royal Gold Sceptre, 11th century B.C. 6½ in. (16.5 cm). Enamel, cloisonné. Discovered in a tomb at Kourion, Cyprus. By kind permission of the Nicosia Museum. Photo by Vassos Stylianou.

Cloisonné began to be used quite differently by the Byzantine artists of the 10th and 11th century A.D. They used the wire to draw images with long flowing lines, creating figures and designs in their work that were narrative of biblical scenes or portraits of saints. The Byzantine metalworkers soldered the cloisonné wire to a very thin, fine gold sheet before inlaying the enamel. They created delicate and detailed work that marked the beginning of the use of enamel for stylized, figural art.



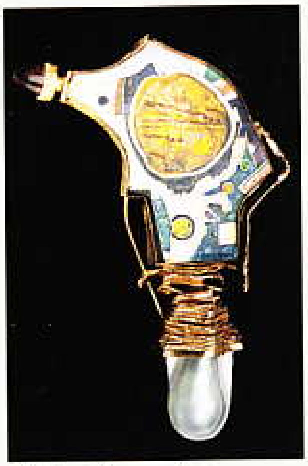
Right: *Medallion from an Icon Frame,* Byzantine, circa 1100. 3¼ in. diameter (8.3 cm). Enamel, gold; cloisonné. From the Djumati Monastery, Georgia (now Republic of Georgia); Made in Constantinople. The Metropolitan Museum of Art. Gift of J. Pierpont Morgan, 1917. Photo by The Metropolitan Museum of Art.



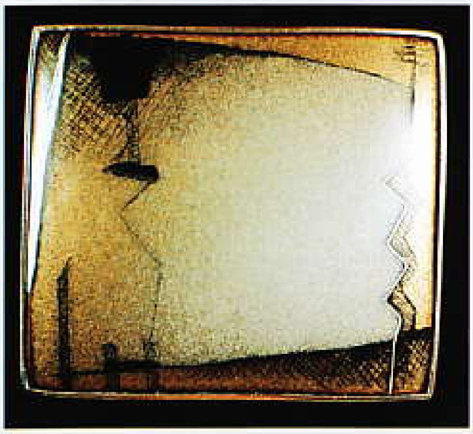
Japanese Cloisonné Enamel Vase, early 1900s. 8 x 6 x 6 in. (20.3 x 15.2 x 15.2 cm). Enamel; cloisonné. Collection of Linda Darty. Photo by Linda Darty.

Enameling may have been introduced into China in the mid-14th or early-15th century from an Islamic source, and it seems enameling was introduced into Japan from China during the end of the 16th century. Because their culture was so separated from the West, most of the Japanese enamel artists in the mid 1800s had to come up with their own methods of working. In the Japanese cloisonné enamels of the 19th century, the wires were not soldered to the metal base. They were held in place temporarily by an adhesive, and then eventually by the fired enamel itself, similar to the way we do cloisonné today.

William Harper, an American enamellist who studied with both Ken Bates and John Paul Miller in the 1960s, developed a very personal way of working with cloisonné wire that did not involve tracing over a drawing or using the wire to simply create enclosed areas for enamel. He began to experiment with a more painterly approach to cloisonné enameling, using the line as a design element in the work and breaking free of the traditional constraints of descriptive or patterned design. Harper's cloisonné work continues to be expressive of ideas, emotions, and cultural comments, as he explores the artistic possibilities of the medium.



William Harper *June Fragment*, 1991. 4⅝ x 2⅝ in. (11.7 x 6.6 cm). 14-karat gold, 24-karat gold, sterling silver, enamel, tourmaline, black pearl; cloisonné. Collection of the Racine Art Museum, Racine, Wisconsin. Gift of Janis and William Wetsman. Photo by the Racine Art Museum.



Rebekah Laskin Untitled, 1982. 1¾ x 1¾ in. (1.9 x 1.9 cm). Copper, enamel, sterling silver, fine silver; cloisonné. Photo by artist.

Jamie Bennett *Raglan Sleeve Pendant,* 1976. 2½ x 2½ x ¾ in. (6.4 x 6.4 x 1.9 cm). Enamel; cloisonné. Collection of June Schwartz.

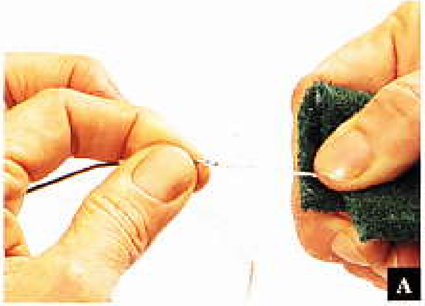
> *"If you treat lines as barriers rather than transitions that describe an area of space, you are limiting yourself a great deal. A line is a visual element, not a technical one. Allow yourself the opportunity to think about the measure of a line, its width and length; the type of line, be it curved, straight, or angular; and finally its expressive quality, which gives life to the line. Once you admit the natural qualities of line in your work, you will find a freshness which is not limited by any process, but enhanced by your awareness."*
>
> Jamie Bennett

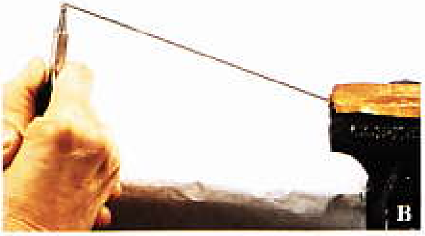
APPLYING THE BASE COAT OF ENAMEL

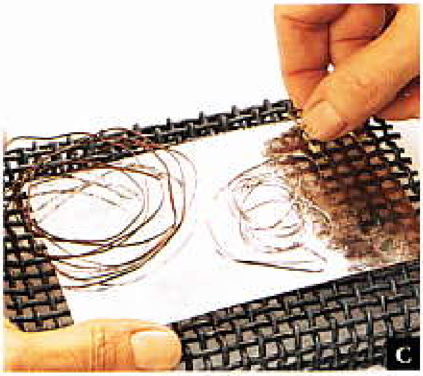
If you use a light-colored base coat, you'll be able to work with layering transparent colors more easily because it's simpler to work from light to dark. If you're layering with opaque enamel, the base coat color is not so important. If you're working on copper, I suggest using a light white or off-white base coat or perhaps clear enamel. If you work on fine silver, you can apply a clean, clear enamel as the base coat. Sift the fine enamel out of the clear enamel, and you may not need to wash the remaining 100-mesh or 80-mesh enamel. If you choose a dark base coat, you might enjoy firing foils onto different areas of the piece, so you'll have some light areas to contrast with the dark color.

FORMING CLOISONNÉ WIRE

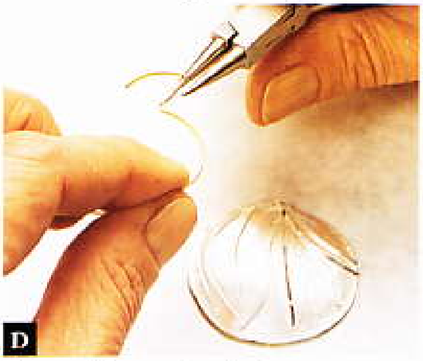
You may find that cloisonné wire needs cleaning or has become crumpled and bent in storage. To clean and straighten the wire at the same time, you can pull it between a folded green scrub pad (photo A). Alternately, you can straighten wire by firmly placing one end in a vise and stretching it with pliers (photo B). To make the wire easier to bend or to form over a three-dimensional surface, you may need to anneal it. Place the coiled wire on a clean firing screen or mica sheet and heat it in a kiln until the trivet or screen glows dull red (photo C). If you're annealing fine silver or gold wire, quench it in water. You must pickle copper or brass wire after annealing to remove firescale.







Forming Cloisonné Wire over a Drawing



Depending on the design, you can form cloisonné wire with your fingers, pliers, or tweezers (photo D). If you intend to create closed wire

Left: Ricky Frank Untitled Pin, 2000. 3½ x 2 x ⅛ in. (8.9 x 5 x .3 cm). 22-karat gold, 18-karat gold, sterling silver, tourmalines, enamel; cloisonné. Photo by Ralph Gabriner.

Far left: Harlan Butt *Horizons: Big Cypress #1*, 2004. 9 x 7 x 4 in. (22.9 x 17.8 x 10.2 cm). Silver, enamel. Photo by Rafael Molina.

cells, make sure the wire ends butt up against each other.

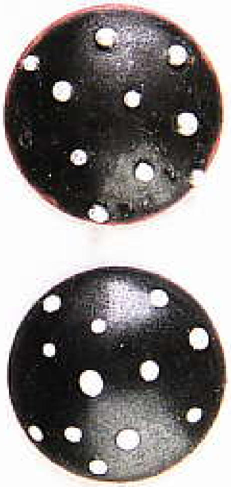
A

If you're working from a very detailed drawing, it might be simpler to form the wire over double-stick tape. This method prevents the wires from slipping and moving as you follow the lines of the design. Better yet, try placing a piece of glass with polished edges over the drawing, and then putting the double-stick tape on top of the glass. This allows you to easily move your work off the drawing to check it and easily slide it back over the drawing to continue working on the wires (photo A).

Beading Cloisonné Wire

B

Cut tiny lengths of fine silver or gold cloisonné wire. Heat them to create metal "beads" that are about the same height as the cloisonné walls as shown in photo B. (You might have to practice with a few different lengths until you make the right size "bead" to fit flush with the cloisonné wire.) When you inlay the enamel around the beads and stone it flush, the beads will appear as solid circles of metal (photo C, top sample). You also can place tiny metal beads on an enamel prior to its final firing, and the beads will remain above the surface of the glass (photo C, bottom sample).



C

Twisting Cloisonné Wires

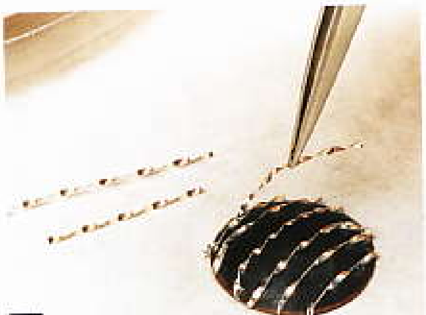
D

Use twisted cloisonné wire to create dotted lines on an enamel surface. Secure one end of a cloisonné wire in a vise and use pliers to twist the opposite end (photo D). Fuse the twisted wire to the enamel surface (photo E), and then apply an

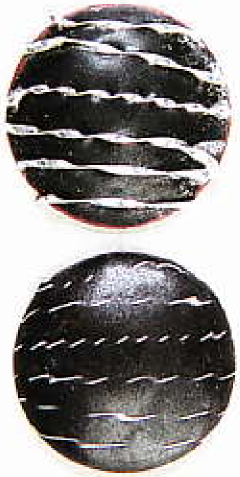
Above: Erica Druin, Marilyn Druin, and **Michael Good** *Emerging Legacy,* 2001–2002. 3¾ x 5¾ x 5¾ in. (9.5 x 14.6 x 14.6 cm). 24-karat gold, fine silver, enamel; cloisonné, basse taille. Photo by Bob Barrett.

Right: Marilyn Druin *Aquamarine,* 1998. 2½ in. (6.4 cm). Fine silver, 24-karat yellow gold, 18-karat yellow gold; cloisonné, basse-taille. Photo by Bob Barrett.

Far right: Frances Kite *Depths of Beauty Brooch,* 2002. 2⅜ x ⅝ x ¼ in. (6 x 1.6 x .6 cm). Fine silver, silver foil, gold foil, enamel, garnet, cultured pearl; embossed, cloisonné. Photo by artist.



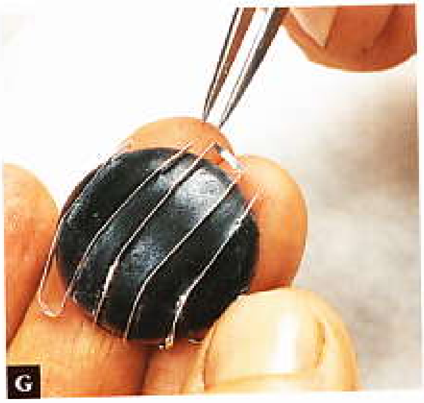
E



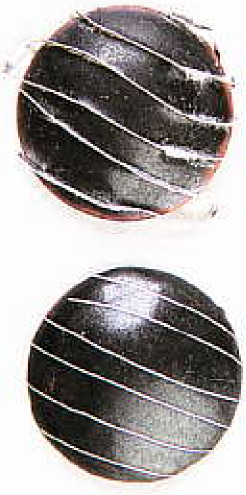
F

opaque color around the twisted wires. The low areas of the twisted wires will disappear beneath the enamel (photo F).

Making Straight Lines with Cloisonné Wires



G



H

To prevent cloisonné wires from falling over in the kiln, each one must be bent so it will balance on its thin edge. One way of making straight lines is to double the length of the wire and extend it off the edge of the piece for balance (photo G). Once the enameling is complete, you can use nail clippers to cut off the excess wire (photo H).

Forming Short Wire Lines by Cutting a "Foot"

Make short lines by cutting a "foot" in the wire as shown in figure A. If you use an opaque enamel to cover the foot, only the short cloisonné wire line will show on the surface.

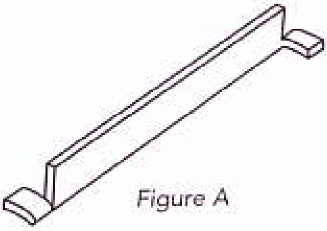
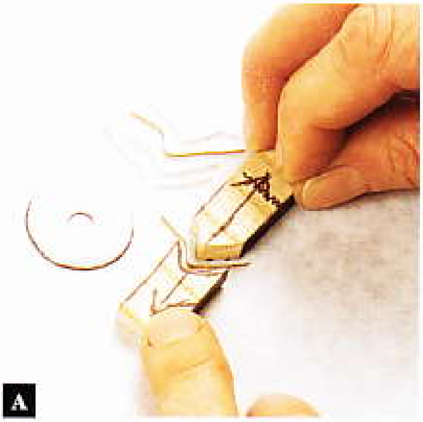
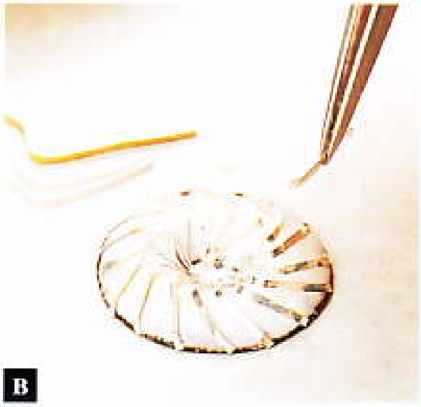


Figure A

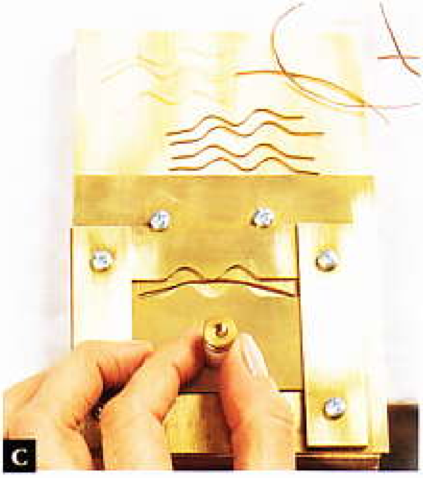
Forming Wire with a Jig

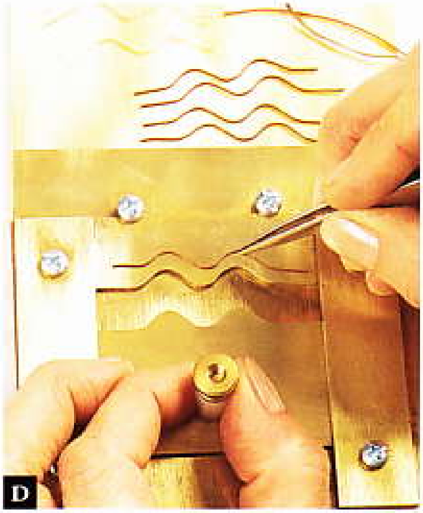

A


B

Corey S. Fong *Spiral Movement,* 2003. 1¾ x 5 in. (6.9 x 12.7 cm). Enamel, silver, copper, garnet, pearl; cloisonné, reticulated, forged.

You can make a tool that will allow you to easily create the same cloisonné shape repeatedly. Corey Fong simply cut this piece of wood and used it to press the zigzag cloisonné shapes in this piece (photos A and B). Place the correct length of cloisonné wire in the jig, and then squeeze the wood pieces shut. As shown in photos C and D, you can also produce a more stable jig that you can adapt to make many different wire shapes. Harlan Butt designed and constructed this example. The brass piece that bends the wire can be removed and replaced with other cut brass pieces.


C


D

ADHERING THE CLOISONNÉ WIRE TO THE BASE-COATED METAL

E

F

If you're working on a flat or slightly domed structure, you can use a holding agent to adhere the cloisonné wires to the base coated piece. Dip the wires in the binder before transferring them to the piece as shown in photo E. Sometimes this method causes the wires to float or move around on the surface of the enamel, and it may be difficult to control a very intricate design. If so, simply paint a smaller amount of holding agent around the wires as you apply them to the piece, as if "gluing" them down (photo F).

G

To apply cloisonné wires to three-dimensional pieces with vertical surfaces, you'll need to use a different binder. Some binders are available from enamel supply companies for this purpose, and my favorite is made from lily root powder or lotus root powder. To mix it, sift the powder into a shallow container of water until the powder covers the surface of the water (photo G). The formula will thicken and form a strong binder into which you can dip cloisonné wires before placing them on the dimensional piece. Once the binder is dry the wires will be so tightly adhered to the enamel surface that they may be difficult to remove.

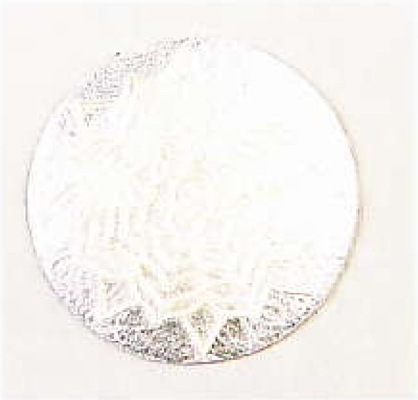
ENAMELING A CLOISONNÉ PIECE

The following samples by Harlan Butt illustrate one way of making a cloisonné piece. Because the artist wanted to apply the enamel color over silver foil, one large piece was applied over the entire base coat. A coat of clear enamel for silver had to be applied over the foil before applying the wires because cloisonné wires will not adhere to silver foil. If you wish to fire foil down in select areas instead of over the entire surface, do this in the first or second firing after the cloisonné wires are attached. (Remember that you must completely fire down foil before coating with enamel. Air bubbles beneath the foil can cause it to rise to the surface and break through the enamel. See page 84 for more information on firing foils.)

1. Cut a disk of copper, slightly dome the form, and clean it well. Apply and fire a base coat of hard clear enamel on the copper disk as shown. (If you plan to cover the entire piece with silver foil, you can use any high-firing enameling color as a base coat. If you use a soft-firing base coat, the cloisonné wires could sink through to the base metal, or the base coat might bleed through the enamel layers fired above it.) Coat the back side of the disk with a counter enamel and fire. You can apply more than one coat of counter enamel if you plan to fire many enamel layers on the front side of the piece.

2. Carefully place silver foil over the top of the disk. Wet the front of the disk with a little water so the foil is easier to position, or you can apply it dry as described on page 82 and paint water under one edge after the foil is in place. Wrap excess foil around the back of the disk or trim it off even with the edge. Let the disk dry, and then fire it to adhere the foil to the enamel base coat. After cooling, sift a thin coat of clear enamel over the silver foil.

3. Bend cloisonné wires into the shape you desire and arrange them on the disk. Adhere the wires to the enamel by either dipping them in a holding agent or painting a holding agent around them as they are placed. Let the finished piece dry well.



4. Fire the wires down at the correct temperature for fusing the base coat. Watch the piece carefully and do not over-fire it! (I find it easiest to watch the trivet: when it turns a dull red color, check the piece.) Remove it from the kiln and use a palette knife or spatula to gently press the wires, checking that they're in place. Work quickly and carefully while the enamel is still hot enough to catch the wires.

Left: Sarah Perkins
Seeded Container, 2003. $4\frac{1}{2}$ x 3 x 3 in. (11.4 x 7.6 x 7.6 cm). Silver, enamel. Photo by Tom Davis.

Far left: Martha Banyas
Untitled Hand Mirror, 1978. $3\frac{3}{4}$ x $3\frac{1}{4}$ in. (9.5 x 8.2 cm). Copper, silver, enamel. Photo by artist.

You can fire all the wires onto the piece at once or you can fire some in place, and then add more in additional firings.

5. Using the wet inlay technique described on pages 33–34, fill the areas around the wires with enamel. Work slowly and carefully. If you're using transparent colors, thin coats of enamel will produce better clarity than heavy coats. Through sequential firings, build up the enamel in thin layers as necessary until flush with the top of the wires (see page 88 for a demonstration of this process). Inlay a little more color around the edge of each cell so that as the enamel pulls toward the center it will be more level (see figure B). Sometimes I fire a piece as many as 20 times to achieve this result.

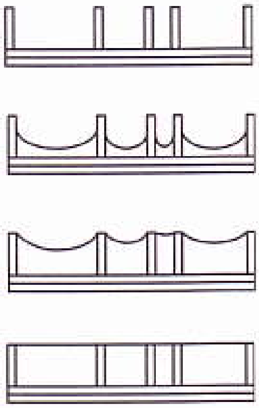


Figure B

6. Once the enamel is flush or nearly flush with the wires, grind the fired surface with an alundum stone or diamond sandpaper to create a smooth level surface. (For more information on grinding, see page 52.) Using only mild pressure, grind the piece under running water until the wires are fairly level. You may want to refill any low areas with enamel and re-fire the piece, rather than continuing to grind it, which will take off more layers of color. (You could also use a lapidary rubber-drum sanding machine to level the wires and finish the surface, but be careful! It's easy to abrade too much color too quickly when using this method. Refer to page 53 for further information on using a rubber-drum sander.)

7. Once the cloisonné surface is completely level, clean it well with a glass brush. Re-fire the piece to heat-polish it to a glossy surface or hand-polish it for a matte finish as described on page 52. File and polish the edges of the piece.

Right: Harlan Butt *Horizons: Olympia #1*, 2004. 6 x 9 x 7 in. (15.2 x 22.9 x 17.8 cm). Silver, enamel. Photo by Rafael Molina.

Far right: Jessica Turrell *Cloisonné Box*, 1997. 3⅛ x 3⅛ in. (8 x 8 cm). 9-karat gold, sterling silver, enamel, fine silver wire; cloisonné. Photo by James Austen.

FAST FACTS & HOT TIPS

— If you have difficulty forming cloisonné wire, try annealing it to soften the metal before you begin. It may also be helpful to re-anneal the wires after forming them and before firing them onto the piece.

— Try forming cloisonné wires over double-stick tape. Following a complicated drawing is much easier if the wires are held in place as you work. Apply the double-stick tape directly to the tracing paper drawing, or to a small piece of glass placed over it.

— Position your worktable at or near eye level while you form wires so you don't strain your neck or back by bending over for too long. Stand up and stretch often!

— Before placing wires on the enameled surface, you may find it helpful to partially grind the base coat with an alundum stone or diamond sanding stick. This will give you a visual indicator that the wires are fired down. (When the ground area becomes shiny, you know the base coat has fused.) Just make sure to grind an area that is large enough to see. If you can't see the rough surface in the kiln, quickly look at it when you remove the piece from the furnace. If it isn't shiny, you'll know to put it back in the kiln. I usually use the color of the trivet (dull red) as an indicator that the base coat has fused and the wires have attached.

— If you over-fire the piece, the cloisonné wires will sink too low. If fine silver sinks down to copper it creates a new alloy known as a eutectic, which melts at a lower temperature than either fine silver or copper. The eutectic will appear black and mottled. If you are afraid of over-firing a piece, take it out at the orange-peel stage each time, until the final firing.

— When wet inlaying a cloisonné piece apply your chosen colors early in the layering process. If you wait until the final few firings to make the piece look the way you want, you may find that you lose those layers during grinding.

— If you're working on fine silver, you should apply clear enamel wherever you plan to inlay a warm color. For example, if I were making a green to yellow blend, I'd apply the darkest greens, middle-value greens, and lightest greens, and put clear enamel in the places that will eventually be yellow. After firing this layer, I'd inlay the yellow over the clear enamel.

— If you're concerned that you may grind or sand through the colors as you level the enamel with the wires, you can apply well-washed clear enamel as a final layer. If you've stoned or sanded your piece after your final firing and you find low spots that need to be filled, you can inlay well-washed clear enamel or a color into those low areas and re-fire the piece.

— If the enamel reaches the top of the cloisonné wires and you realize that you'd like to change or add a little more color, you can! Simply use a small round diamond bit in a flexible shaft machine to remove the color you want to replace. Wear a dust mask and be sure to wet the enamel so the diamonds won't come off the bit. You can even use the wet diamond bit to blend colors by grinding and softening edges. Be careful not to damage the cloisonné wires during grinding.

— Early in the wet inlay process, if you decide you don't like a color, you can apply foil over it. Be careful, though. If you wait too late to add the foil, you might end up grinding it away when you level the surface.